Rock Products

TRADEPRESS PUBLISHING CORPORATION
542 SOUTH DEARBORN STREET
CHICAGO

NATHAN C. ROCKWOOD, Editor CHAS. H. FULLER, Manager C. F. TREFZ, Associate Editor

Vol. XXIII, No. 11 May 22, 1920

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Second class entry at U. S. Post Office.

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PULVERIZING
AIR-SEPARATING
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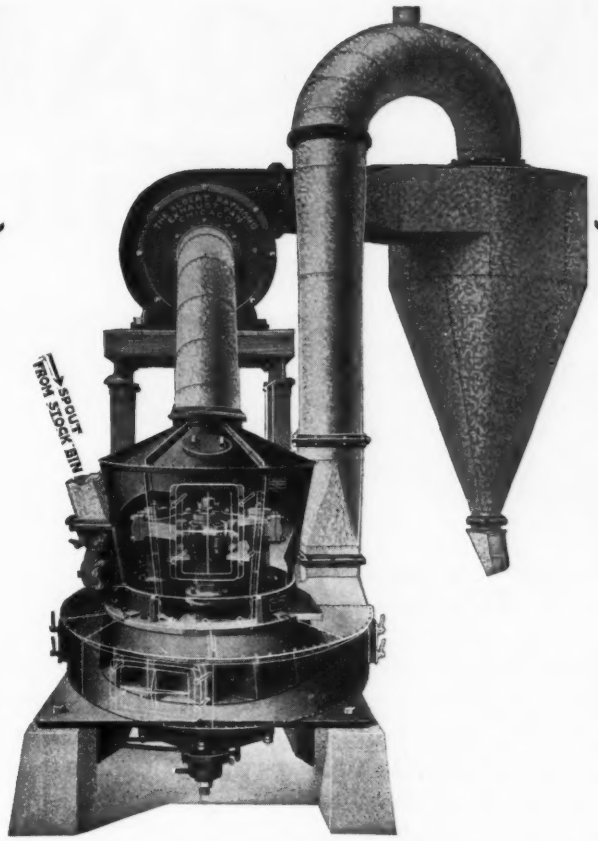

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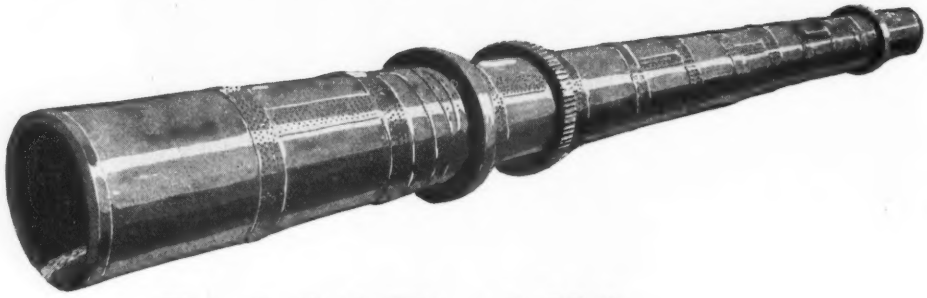

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Nearly 2000 VULCAN Rotary Kilns are used in 65 different industrial processes.

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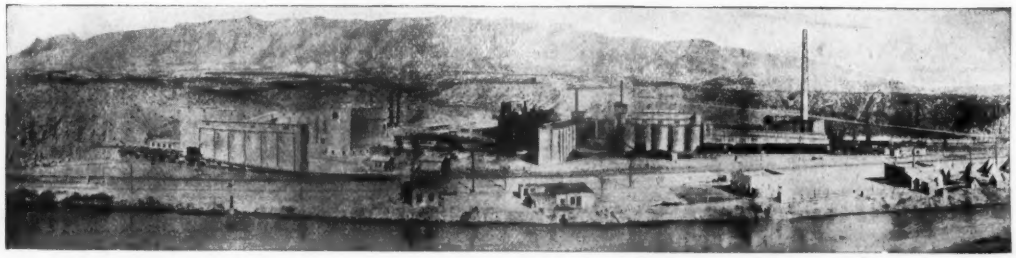

General Views of Plant of South Western Portland Cement Co., El Paso, Texas.

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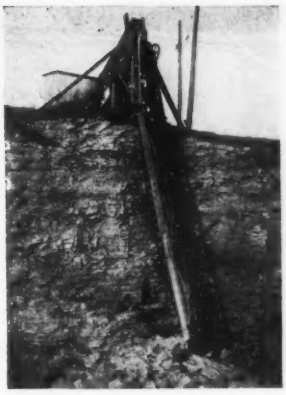
For Elevating and Conveying in Quarries



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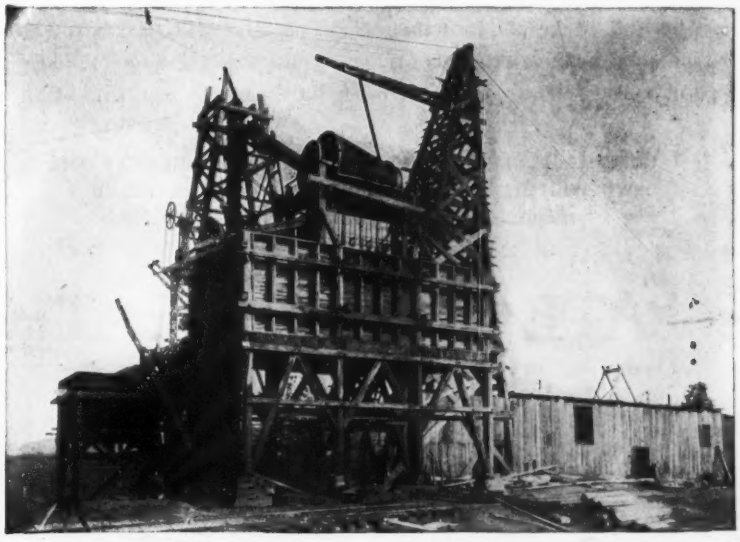

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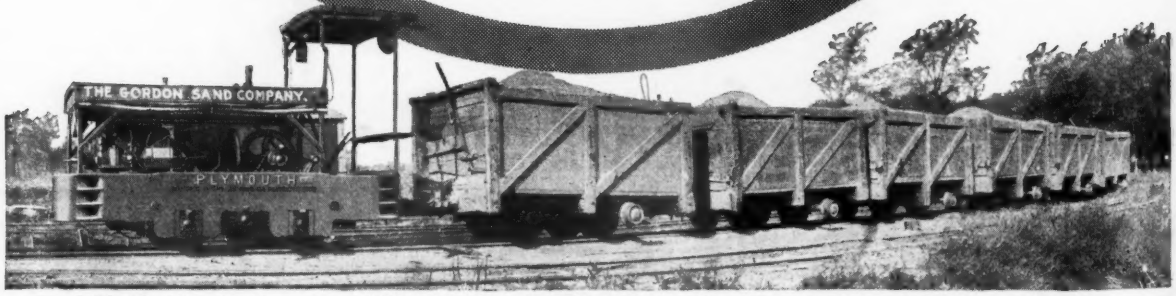

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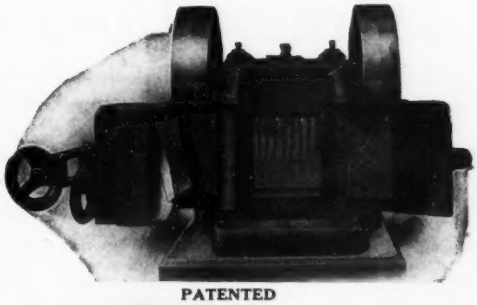

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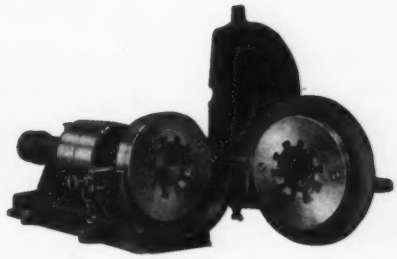

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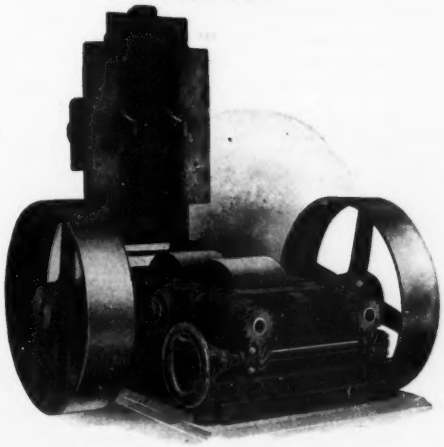

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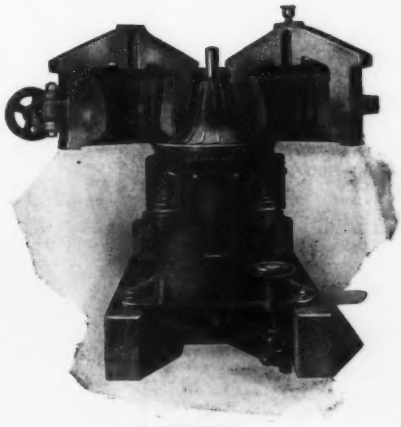

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Duplex Limited Specifications

Capacity—Normal Load 3000 lbs. Maximum allowable weight including body 5000 lbs.

Speed—5 to 30 miles per hour on high speed. The Duplex *Limited* will attain and *hold* a speed of 25 miles per hour with a full load, and *normal engine speed.*

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Cooling—Special Duplex design Radiator with cast tanks and finned head. Spirex core. 18-inch fan driven by 2-inch leather belt. Centrifugal water pump.

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Front Axle—Drop Forge I-Beam 2⅝-inch deep.

Rear Axle—Straight or David Brown type of worm gear, with 5.51 ratio.

Springs—Semi Elliptic—front and rear.

Wheels—Heavy Artillery type—12 spokes 1¾-inch square.

Tires—Pneumatic Cords 35x5 front; 38x7 rear.

Wheelbase—145 inches.

Equipment—Windshield; Electric starting and lighting; Ammeter; Boyce Motometer; Speedometer; Electric Horn; Tools; Jack; Rim wrench. Front fenders; Alemite High Pressure Lubricating System; Driver's seat without extra charge. (Power tire pump at extra charge.)

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A Wonderful, Medium Capacity, High Speed Truck That is Establishing Remarkable Operating Records

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Pneumatic Tired—Full Electric Equipment—Speed 5 to 30 Miles per Hour on High with Full Load—Here is a Speed Truck That Can Really Stand Speed Work.

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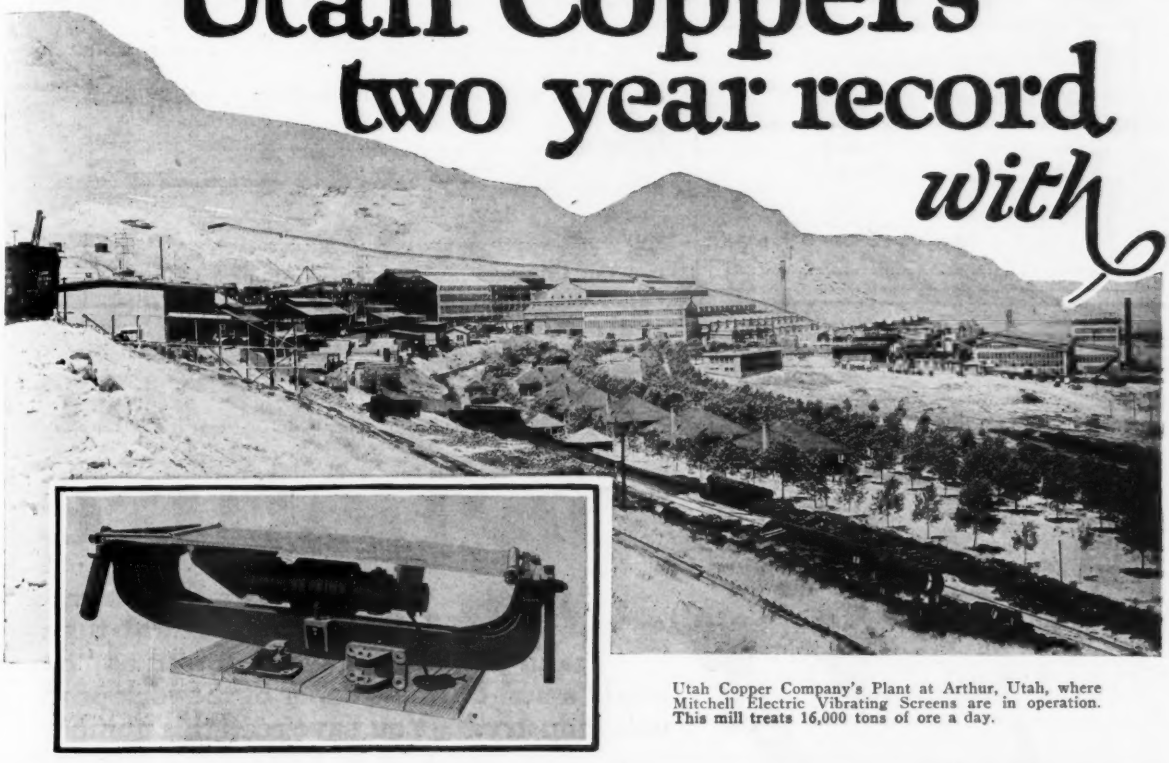

Utah Copper Company's Plant at Arthur, Utah, where Mitchell Electric Vibrating Screens are in operation. This mill treats 16,000 tons of ore a day.

MITCHELL ELECTRIC VIBRATING SCREEN

The Utah Copper Company was the first great concern to install Mitchell Electric Vibrating Screens. They have been in operation in the company's big mill at Arthur, Utah, for two years, with astonishing records of efficiency.

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In coarse crushing work each Mitchell Screen is delivering a screened product of more than 1,200 tons per 24 hours of minus ½ inch material.

FINE CRUSHING, DRY WORK

In fine crushing, dry work, each Mitchell is delivering a screened product of more than 600 tons per 24 hours of minus 10 mesh material.

FINE CRUSHING, WET WORK

In fine crushing, wet work, each Mitchell is delivering a screened product of more than 650 tons per 24 hours of minus 10 mesh material.

The Mitchell forces the meshes up into the material 3,600 times a minute with an impact of from 500 to 1,000 pounds. Therein lies the revolutionary characteristic of the Mitchell — the feature which is making possible the records shown not only at the Utah Copper Company's mill but in a variety of other industries, such as coal and coke, sand and gravel, fertilizer, salt, etc.

Ask us for records of special tests of the Mitchell, which we shall be glad to furnish you together with complete information as to construction and operation

STIMPSON EQUIPMENT COMPANY

Manufacturers and Sole Agents

315 FELT BUILDING SALT LAKE CITY, UTAH

ROCK PRODUCTS
542 So. Dearborn St., Chicago, Ill.

Date.....1920

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- ☐ Sand and Gravel
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- ☐ Lime
- ☐ Gypsum
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- ☐ Plaster

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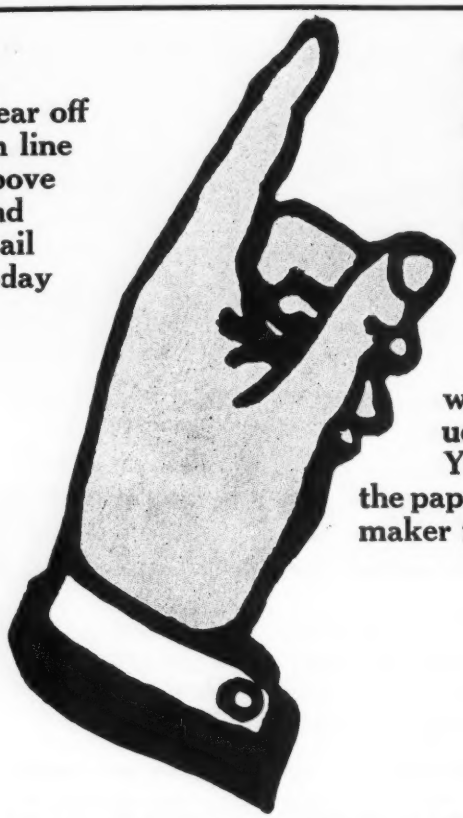

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Here is a blank for your convenience in subscribing to what several thousand producers have endorsed as "the world's best business paper of the rock products industry." You have read this number. You know that ROCK PRODUCTS is just the paper you have been looking for. It is a money-maker for those who use its services.

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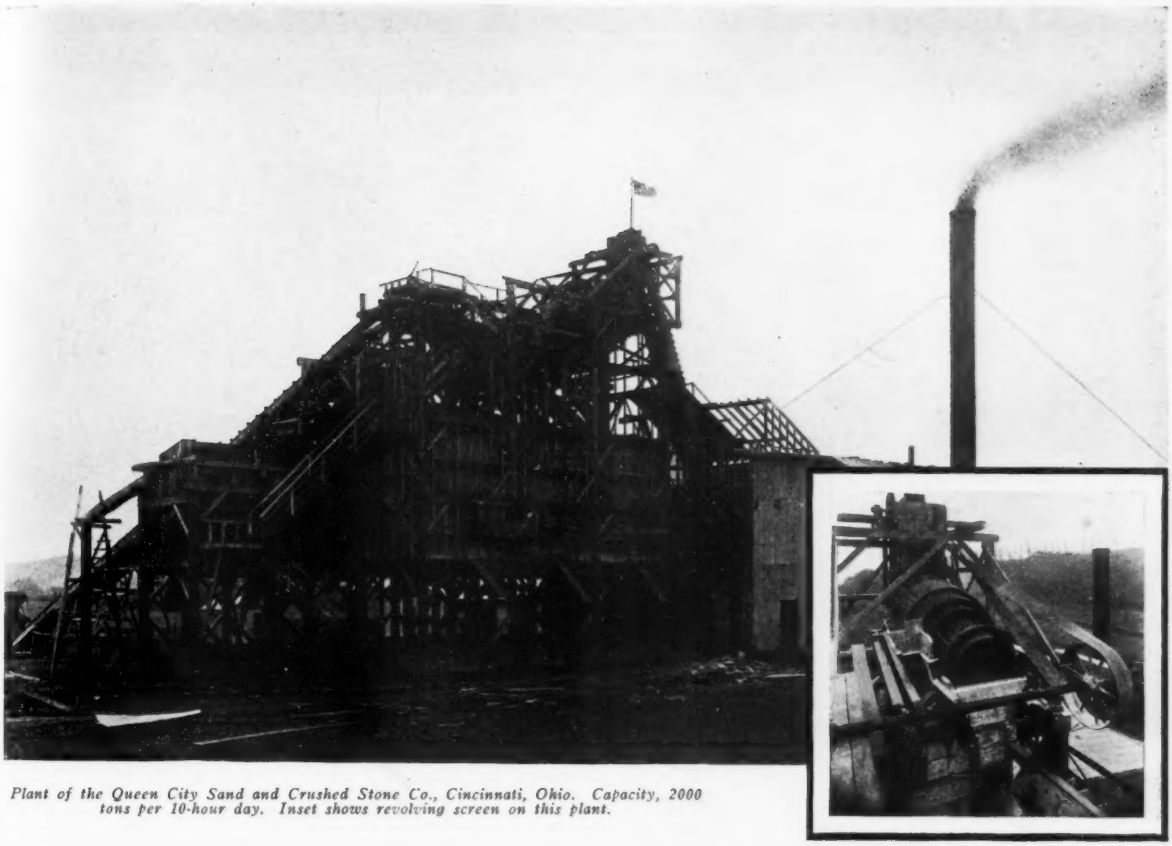

Plant of the Queen City Sand and Crushed Stone Co., Cincinnati, Ohio. Capacity, 2000 tons per 10-hour day. Inset shows revolving screen on this plant.

EQUIPMENT—and *Service*

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Fort Wayne, Ind.
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Denver, Colo.
Billings, Mont.
Boise, Idaho
San Francisco, Calif.
Los Angeles, Calif.

The basic machinery of sand and gravel excavating, elevating, conveying, crushing, screening and washing outfits is the most important consideration. Every piece of Good Roads equipment is manufactured in our own factories and represents many years of experience.

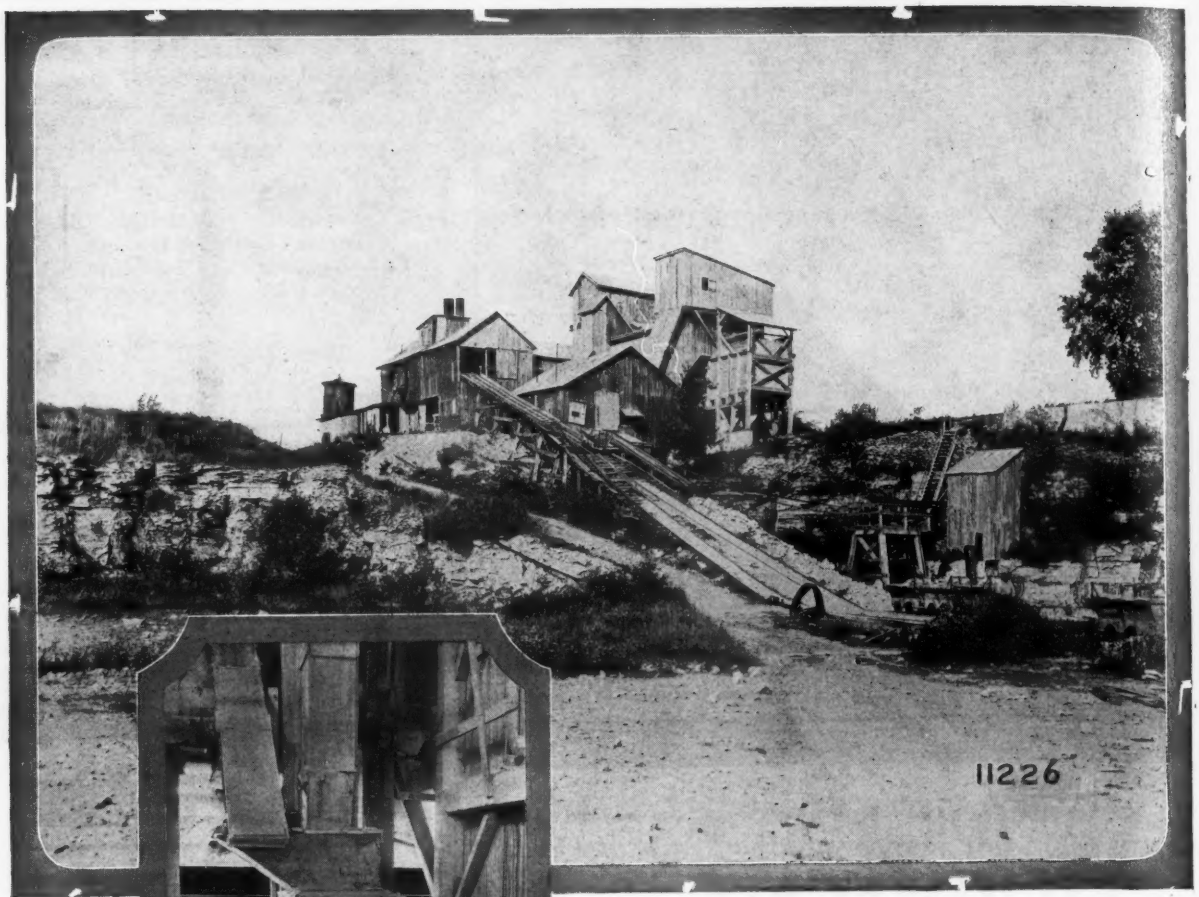
But we do not stop there. Our Engineers are at your service for the planning, building and installation of complete plants of any size for any purpose. We will gladly study your problem, offer suggestions, and submit estimates on any type of plant.

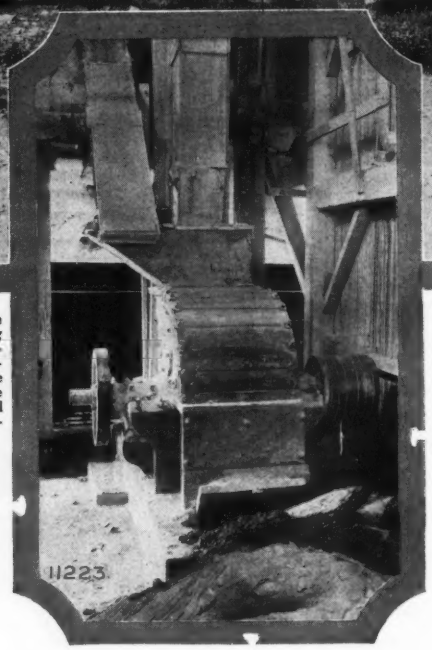
Write for Catalog No. 5

GENERAL SALES OFFICES
832 Bulletin Building **Philadelphia, Pa.**

The GOOD ROADS Machinery Co., Inc.

When writing advertisers please mention ROCK PRODUCTS





Jeffrey Type "A" Swing Hammer Pulverizer in operation at the plant of the Broken Sword Stone Co., Bucyrus, Ohio.

MANY Lime and Limestone Plants Such as Illustrated Above Are Using

Jeffrey Swing-Hammer Pulverizers

for reducing Burnt Lime and Limestone to various commercial products.

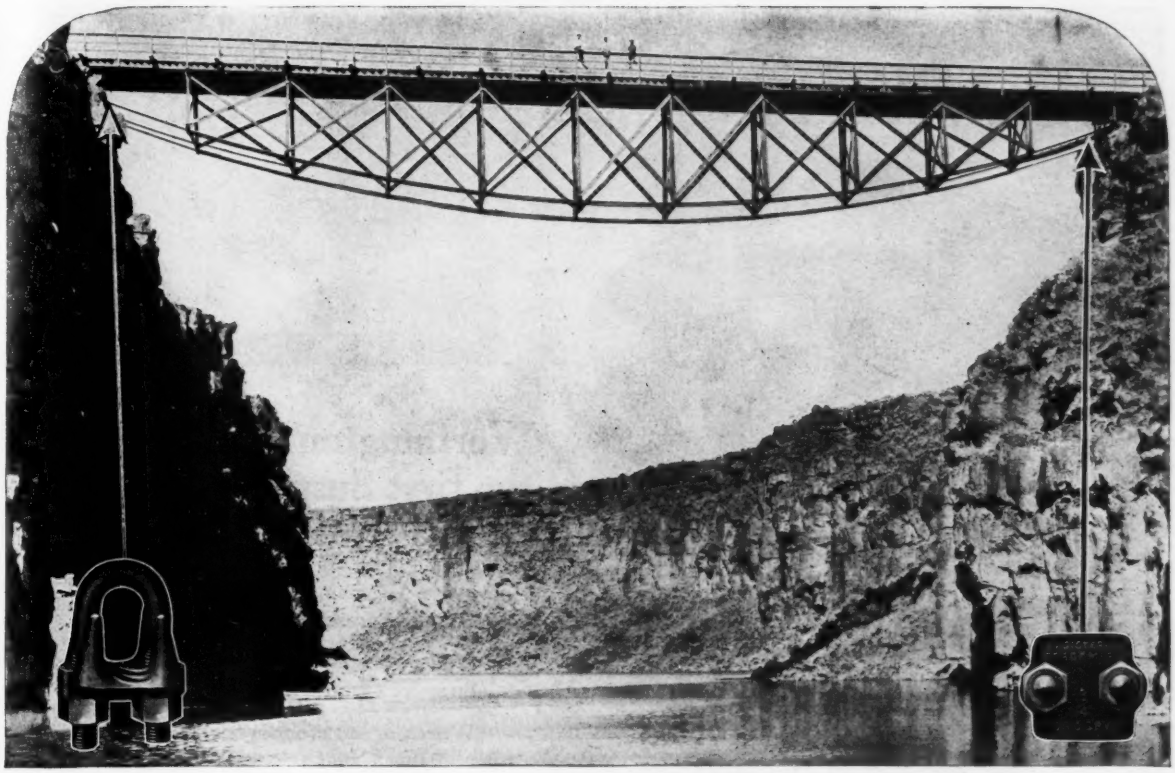
Machines made in several types suited to a variety of materials and products, and in numerous sizes adapted to plants of all capacities.

Write for Pulverizer Bulletin No. 147-D

The Jeffrey Mfg. Co., 935 North Fourth St. Columbus, Ohio

New York Boston | Scranton Philadelphia | Cleveland Pittsburgh | Chicago St. Louis | Birmingham Dallas | Milwaukee Seattle | Denver Los Angeles | Montreal Detroit

Manufacturers of Pulverizing, Conveying and Elevating Machinery; Chains; Self-Propelling Loaders; Electric Trolley and Storage Battery Locomotives, etc.



"TEMPORARY" SUSPENSION BRIDGE TEN YEARS OLD STILL IN SERVICE.

When the Salmon River Dam was being built in 1910, a temporary suspension bridge was built across the canyon for the convenience of the construction forces. This unique bridge, which was designed for a ten ton live load, is supported by thirty-four ¾-inch cables, seventeen on each side. Each side is one continuous cable woven through U-bolts, cemented in the rock and fastened with Genuine "CROSBY" Clips.

Built for a short period of use, this bridge has continued in service for ten years, and to all appearances has many years of usefulness left. No stronger proof could be asked of the correctness of the design and the durability of the materials used in this bridge, especially the Genuine "CROSBY" Clips, on the grip and weather-resisting qualities of which hinge the life of the whole structure.

"CROSBY" Clips have a correct gripping design. They are drop forged from steel bars. They are heavily galvanized. Safest —cheapest because safest.

American Hoist & Derrick Co.

Saint Paul Minnesota

Builders of "AMERICAN"

Hoisting Engines
Electric Hoists
Derricks

Locomotive Cranes
Railroad Ditchers
Logging Equipment

Sugar Cane Machinery
Marine Deck Machinery and Tackle
The Genuine "CROSBY" Wire Rope Clip

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AMERICAN HOIST & DERRICK CO.

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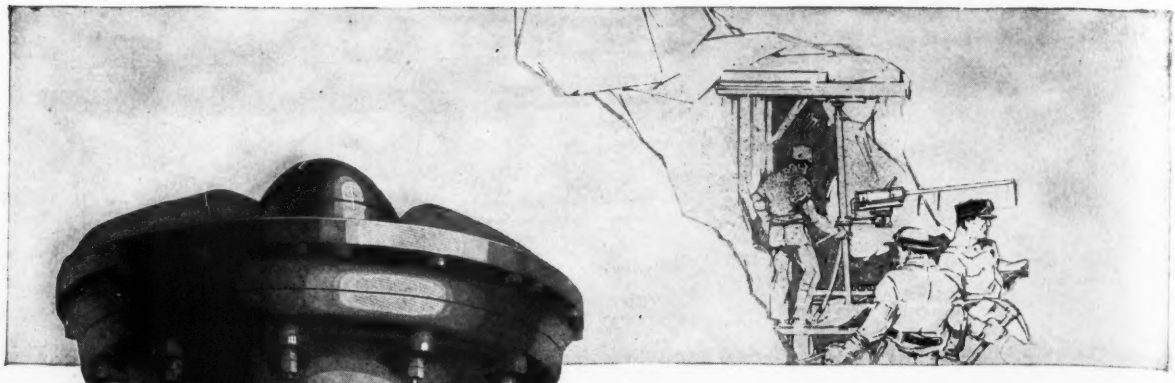

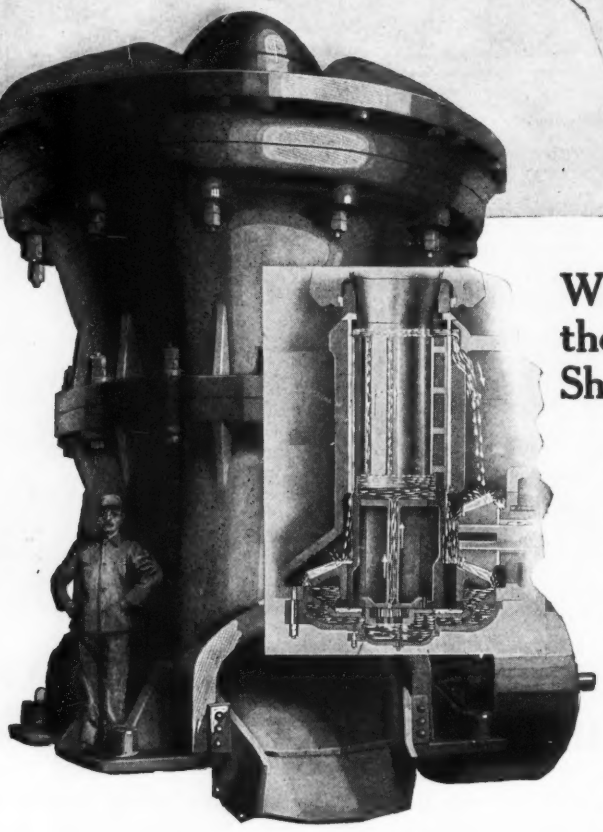

Worthington built the first Suspended Shaft Gyratory

1904—Worthington built the first No. 10 Standard Gyratory.

1909—Worthington built the first 10-inch Superior Gyratory.

Worthington pioneered in large Gyratory and Jaw Crusher construction.

Worthington Superior Suspended Shaft Gyratory is the original machine of its type, was designed and built by Worthington years in advance of competing machines and has proved successful in over 250 installations ranging in size from 10-inch to 36-inch openings.

Tell us your requirements, and we will offer a machine to suit your needs. Superior McCully is built in sizes from 10-inch to 60-inch openings: capacities from 30 to 1,500 tons per hour. Engineering service for crushing plants is freely tendered and without obligation to you.

Send for Bulletin P. M. 50

Worthington Pump and Machinery Corporation
***Executive Offices:* 115 Broadway, New York City**
Branch Offices in 24 Large Cities

Oiling System

"Superior" lubrication is force-feed by means of spur geared oil pump under constant head of oil, positively delivering ample supply at all times to eccentric bearing and gearing. This force-feed cannot be compared with systems using plunger pump and check valves which are often unreliable.

Other Worthington Products

Gyratory Crushers, Jaw Crushers, Air Compressors, Mine Pumps, Revolving Stone Screens, Ball and Tube Mills.

PUMPS—COMPRESSORS—CONDENSERS—OIL & GAS ENGINES—METERS—MINING—ROCK CRUSHING & CEMENT MACHINERY

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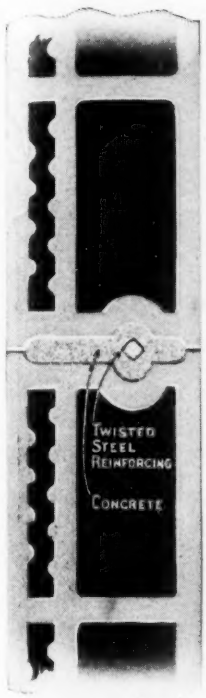
Blake & Knowles Works *East Cambridge, Mass.*
Worthington Works *Harrison, N. J.*
Epping-Carpenter, *Pittsburgh, Pa.*
Laidlaw Works, *Cincinnati, Ohio.*
Gas Engine Works, *Cudahy, Wis.*
Power & Mining Works *Cudahy, Wis.*
Snow-Holly Works *Buffalo, N. Y.*



Vertical Cross Section of wall showing the Preston-Lansing method of reinforcing.

Nothing Better for Storing Limestone, Sand, Glass Batch Bins, etc.

"We believe there is nothing on the market that will make a better storage bin for limestone, glass, sand or any such material than your 'ship-lap' Vitrified Tile Storage Bins provided with reinforcing of proper size twisted steel bars to each layer of tile," says the Becker Limestone Company, whose Preston-Lansing Storage Bin is illustrated below.

Preston Lansing Tile Storage Bins

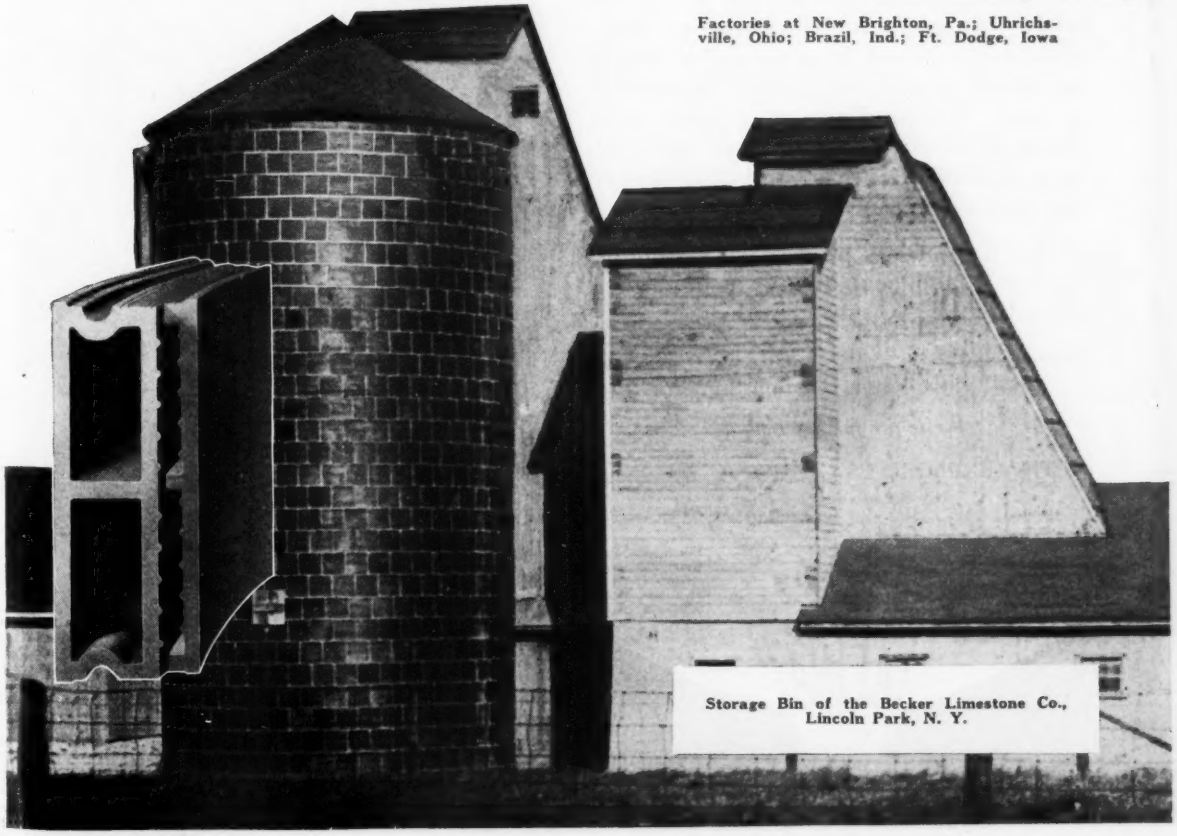
—reduce fire hazards—are moisture-proof and have no upkeep expense. Our special method of construction makes a bin with strength to withstand any strain. The blocks are braced against each other in "ship-lap" formation and reinforced between each tier by a twisted steel bar embedded in a thick layer of concrete.

Let us send you complete information showing how Preston-Lansing Bins have proven most economical in all parts of the country. Ask for catalogue and prices.

J. M. PRESTON COMPANY

Department 416 **Lansing, Michigan**

Factories at New Brighton, Pa.; Uhrichsville, Ohio; Brazil, Ind.; Ft. Dodge, Iowa



Storage Bin of the Becker Limestone Co., Lincoln Park, N. Y.

Make Every Shot *COUNT!*

WITH PRODUCTION COSTS mounting higher and higher, it is more essential than ever that you make every dollar's worth of explosives do a dollar's worth of work.

All doubt in this direction is set at rest when you use Aetna Explosives. They are manufactured from special formulas designed to give maximum disruptive power. Properly placed and fired, Aetna Explosives bring down the rock in profitable quantity—and shattered to the desired size.

Aetna Explosives, moreover, being uniform in quality, can always be depended upon to give the same results.

Aetna Explosives are most effective when used with Aetna Blasting Supplies.

Write for full particulars

AETNA EXPLOSIVES COMPANY, Incorporated
165 Broadway, New York

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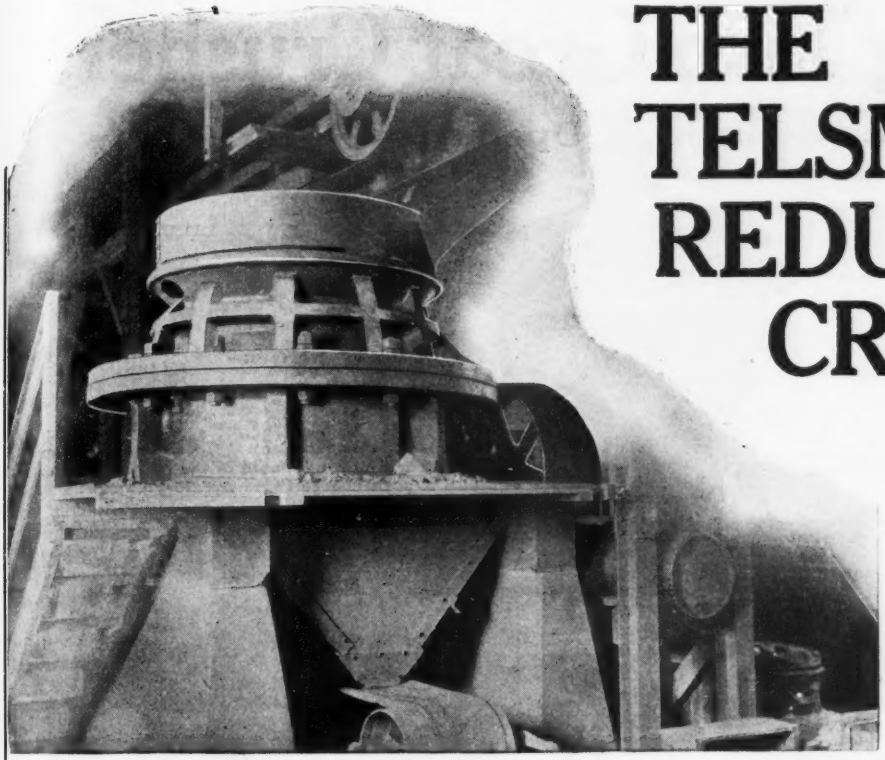
AETNA

It does the work!



THE TELSMITH REDUCTION CRUSHER

A machine specially designed for re-crushing rejections to size suitable for road "topping" and concrete aggregate.

There are many plants where a No. 7½, 8, 9 or 10 gyratory crusher is followed by a *whole regiment of smaller gyratories.* The secondary crushers are generally covered with rock and apparently working to full capacity—yet the output is small considering the amount of equipment used. Why? Because the ordinary gyratory crusher, whether big or little, is designed to take the largest possible rock and not to crush rejections. When used as a follow-up crusher, the large feed openings of a coarse breaker are wasted because the upper part of the hopper is used for storage only. Crushing service is concentrated at the bottom of the head, and the discharge area is generally too limited to clear the bowl efficiently. Consequently power consumption and maintenance expense are high, while output is disappointing.

For re-crushing, USE A MACHINE SPECIALLY DESIGNED FOR THIS SERVICE—the Telsmith Reduction Crusher. You can cut in half the number of machines required; reduce the amount of over-size returned; save power and maintenance expense.

Our bulletin No. 2-F-11 will tell you the rest of the story about the Telsmith Reduction Crusher. Also glad to send you our catalog No. 166, describing Telsmith Primary Breakers.

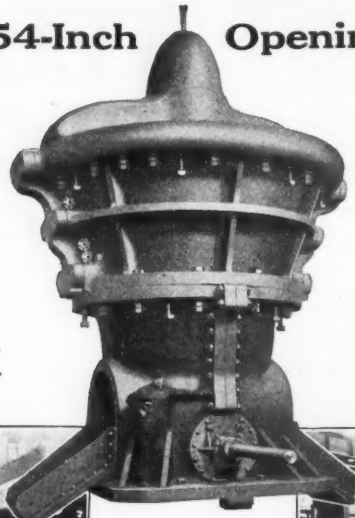
SMITH ENGINEERING WORKS

3188 Locust Street, Milwaukee, Wis.

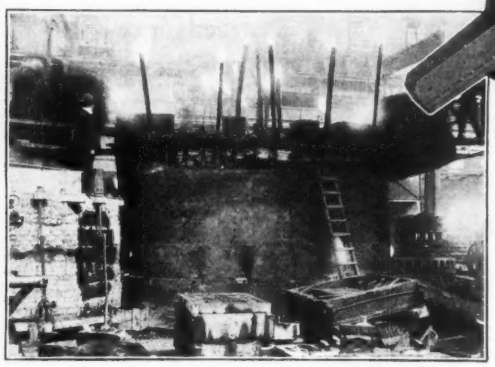
Old Colony Bldg. Chicago, Ill.
30 Church St. New York City
710 Witherspoon Bldg. Philadelphia, Pa.
930 Oliver Bldg. Boston, Mass.
110 W. Park Way, N. S. Pittsburgh, Pa.
325 W. Main St. Louisville, Ky.
6110 Euclid Ave. Cleveland, Ohio
2540 University Ave. St. Paul, Minn.
Brown Frazer & Co. Vancouver, B. C.
Franklin and Channing Aves. St. Louis, Mo.
Salt Lake Hardware Co. Salt Lake City, Utah
Road Builders Equip. Co. Portland, Ore.
625 Market St. San Francisco, Calif.
Watson, Jack & Co. Montreal, P. Q.
Kelly Powell, Ltd. Winnipeg, Man.

Building Two Great Crushers

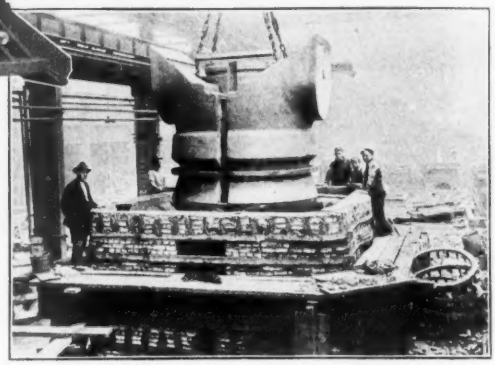
With 54-Inch Openings



Pouring the Bottom Shell of the No. 27 Double Discharge Gates Gyratory Crusher



Lowering the Central Core of the Bottom Shell into the Mould of the No. 27 Double Discharge Gates Gyratory Crusher



This is the second of a series of "Progress Photographs" taken during the construction of the two

Largest crushers ever built by this company for one of the largest copper mining companies in the world

In pouring each one of the top shells of these crushers there were used two ladles of 40 tons capacity each, and for pouring the bottom shells one ladle of 40 and one of 30 tons capacity.

In the first advertisement of this series, shown in the April 24th issue, we advised you that our success is due to our building every crusher complete in our own shops, without "subletting" any part thereof, because we have the shop facilities, the engineering and mechanical skill and experience acquired during the many years this Company has been engaged in the successful building of crushers for every condition of operation in every part of the world.

We now emphasize the fact that our crushers, being built complete in our own shops, insure the purchaser against misfits, with their incident delay, annoyance and expense in replacing parts, which result when "assembling" parts manufactured by several concerns to make one machine.

We also call your special attention to our West Allis Works foundry, which is 992 ft. long, 218 ft. wide, equipped with every facility forming a part of a modern foundry. Castings weighing as much as 125 tons each are cast in this foundry, which gives an idea of the ease with which the largest castings for this crusher were made.

This Company can, therefore, look forward with optimism toward being able to build in its own shops, complete crushers of much greater size and capacity than the two here mentioned, should there be an economic demand for same.

In our next advertisement, in the June 19th issue of this publication, further details will be given.

Write for Bulletin No. 137-C

ALLIS-CHALMERS PRODUCTS
Electrical Machinery
Steam Turbines
Steam Engines
Gas and Oil Engines
Hydraulic Turbines
Crushing and Cement Machinery
Mining Machinery

ALLIS-CHALMERS MANUFACTURING COMPANY
Milwaukee, Wisconsin, U. S. A.
District Offices in All Leading Cities

ALLIS-CHALMERS PRODUCTS
Flour and Saw Mill Machinery
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Pumping Engines-Centrifugal Pumps
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Air Compressors - Air Brakes
Agricultural Machinery
Condensers

Rock Products

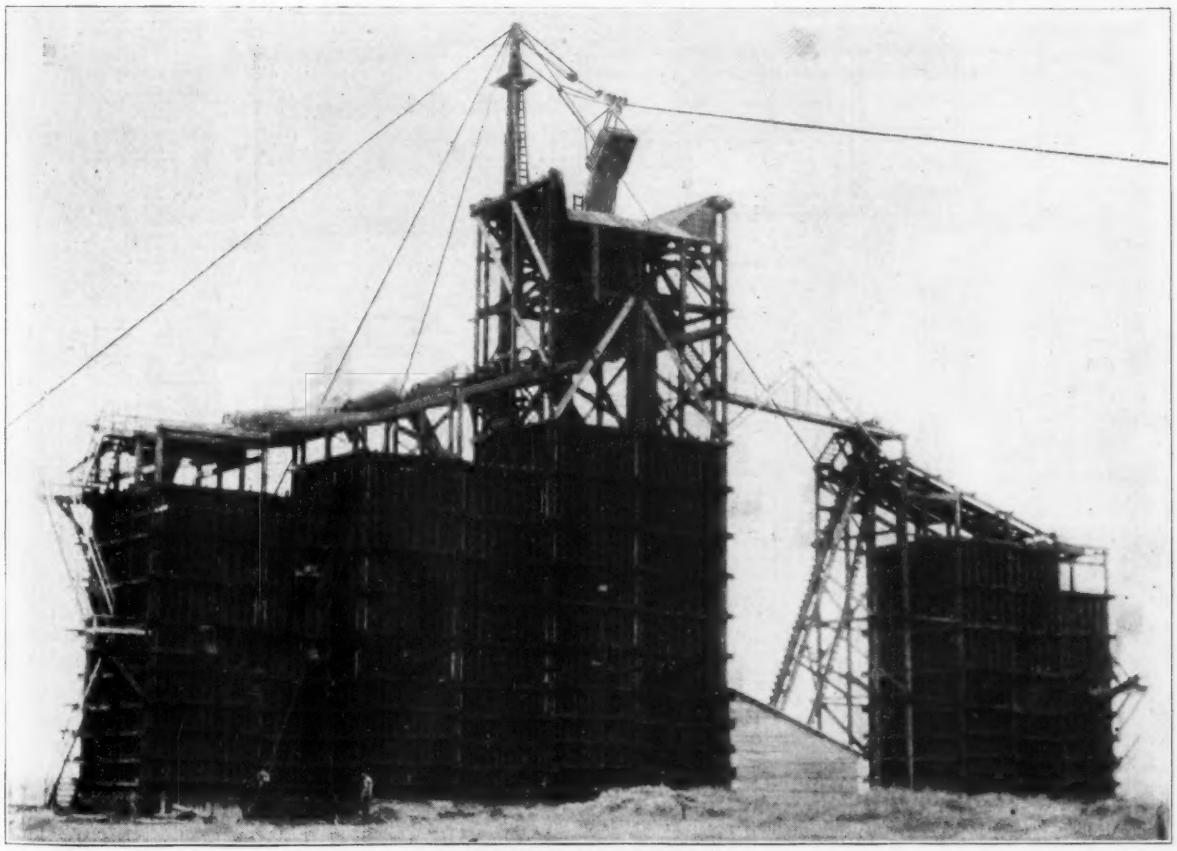
Vol. XXIII | Chicago, May 22, 1920 | No. 11

Completely Designed Sand and Gravel Plant

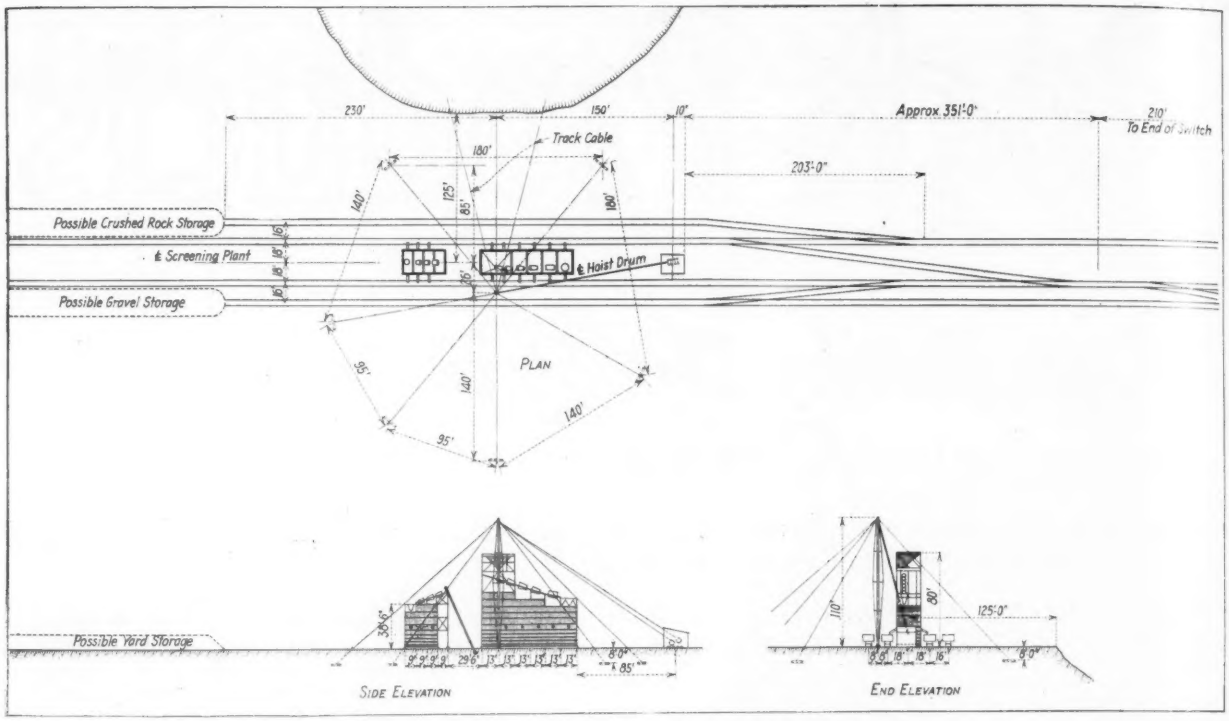
Iowa Plant Operated with Dragline Excavator Makes Separate Crushed Stone and Sand and Gravel Products—Complete Detail Drawings of Plant

THE AUTOMATIC GRAVEL PRODUCTS CO., which is located about one-half mile west of the Mississippi River and two miles south of Muscatine, Iowa, is a good example of the growing tendency among sand and gravel producers to expend considerable time and money to completely design their plants before starting construction. This company, which was recently formed, has built a plant that possibly had more details worked out in advance than any other similar plant. The complete working drawings accompany this article.

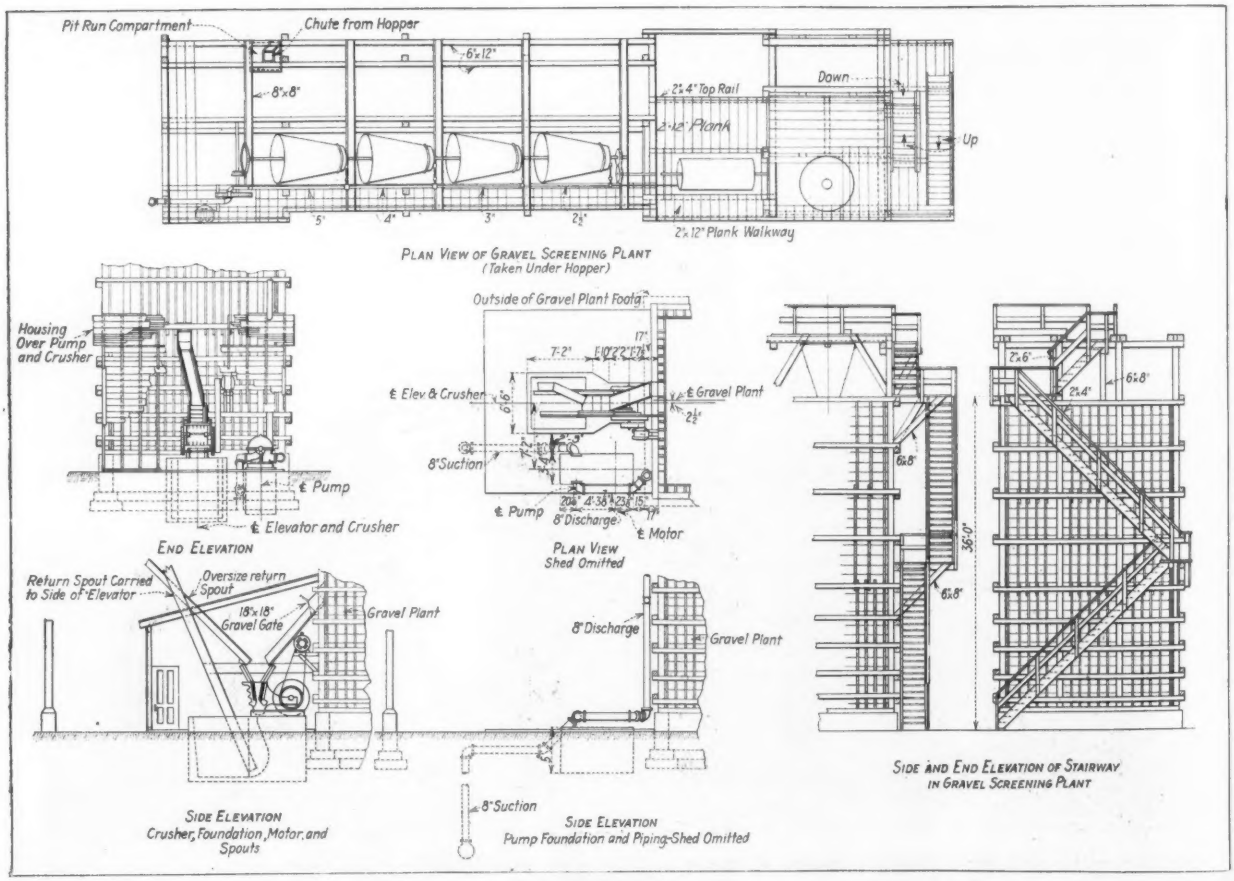
J. N. Hatch, consulting engineer of



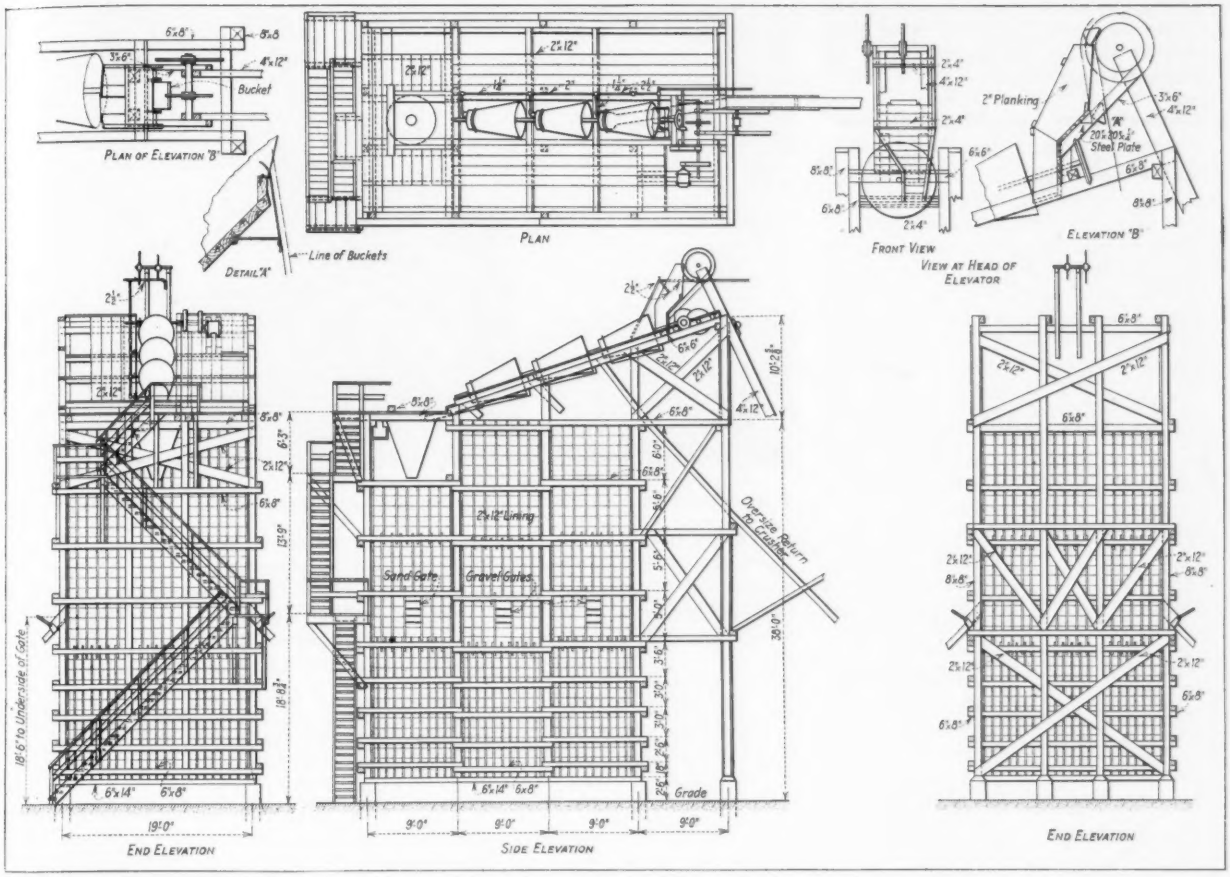
The plant of the Automatic Sand and Gravel Company at Muscatine, Iowa, showing separate crushed stone and sand and gravel screening plants

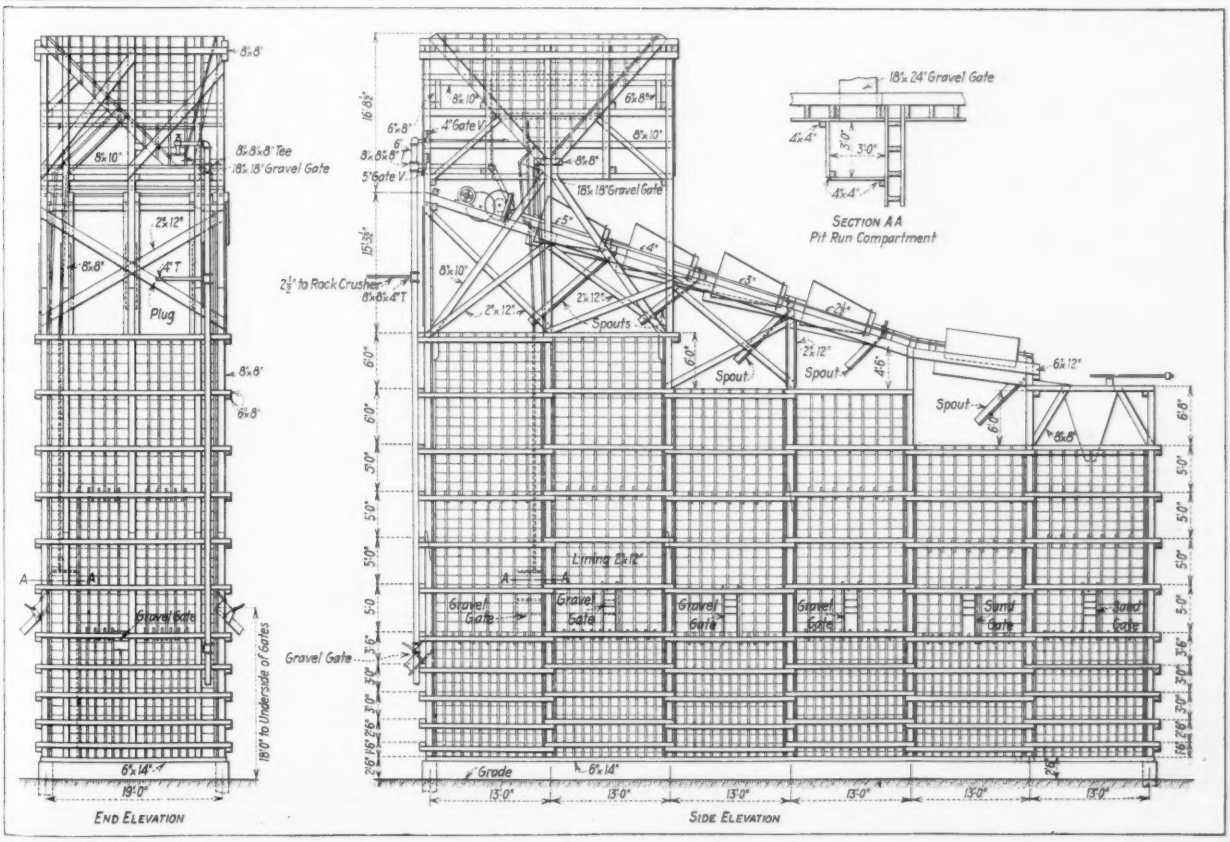


Plan view, side and end elevation of the entire plant layout



Elevation and detail plans of crusher mounting and gravel screening plant


Plan of Elevation "B"
Bucket
Detail "A"
Line of Buckets
Plan
Front View
View at Head of Elevator
2" Planking
Steel Plate
Elevation "B"
End Elevation
Side Elevation
2"x12" Lining
Sand Gate
Gravel Gates
Oversize Return to Crusher
Grade
End Elevation

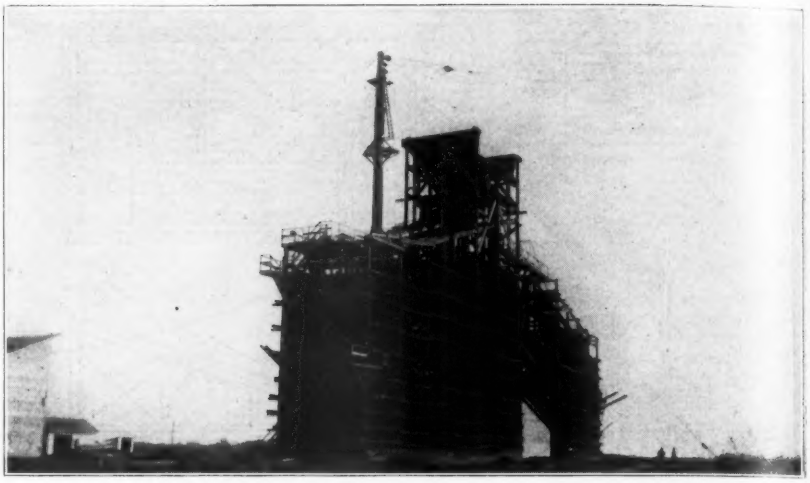

8"x8" Tee
8"x18" Gravel Gate
Plug
Gravel Gate
End Elevation
18"x24" Gravel Gate
Section A A
Pit Run Compartment
2½" to Rock Crusher
Spouts
Spout
Lining 2"x12"
Gravel Gate
Sand Gate
Grade
Side Elevation

Chicago, is the designer of the washing plant and layout, and Sauerman Bros., also of Chicago, designed the drag line and excavation layout.

Company Owns Large Gravel Deposit

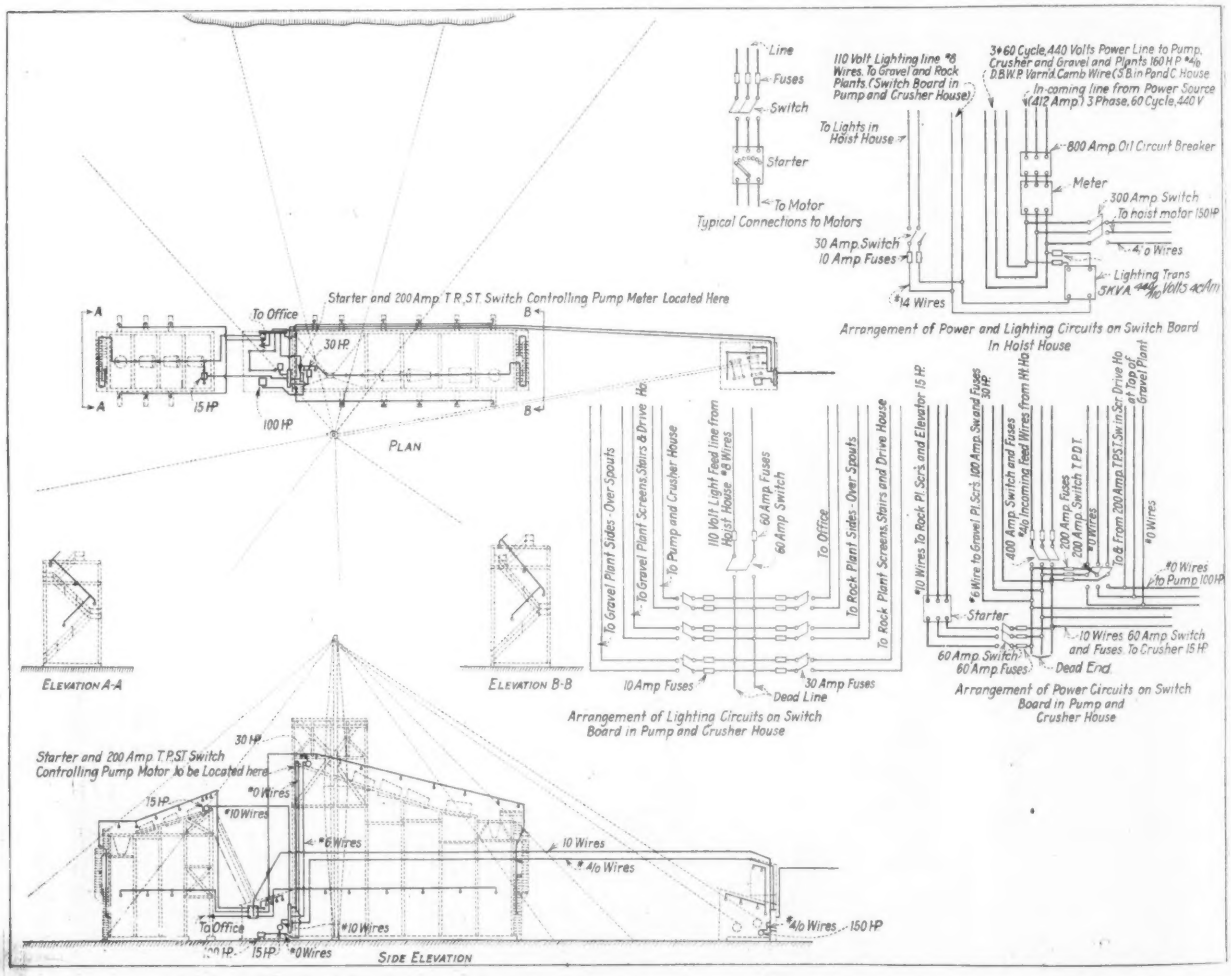
The Automatic Gravel Products Co. has purchased quite an extensive tract of gravel property. The clean gravel extends to a depth of 50 to 60 ft. and has practically no overburden at all. The normal water level is almost 12 ft. below the surface, thus making necessary some method of excavation that will remove material from below the water level. This material is mined by a 2-cu. yd. Sauerman drag line cableway excavator, which has a span of about 750 ft. The mast to which the dragline is attached is 110 ft. high and the screening tower is about 85 ft. high.

The cableway excavator is operated by a Lidgerwood electric hoist driven by a 150-h.p. alternating current, two-speed motor. The plant as designed is intended to handle 1,500 cu. yds. of sand and gravel per day. At present only one set of screens is in use. The plan detail of the top of the screening plant and bins shows that the set of screens now in use is mounted to one side so that in the future, when it is desired, the present capacity may be doubled by putting in a second set of screens and a sand-settling box on the other side.

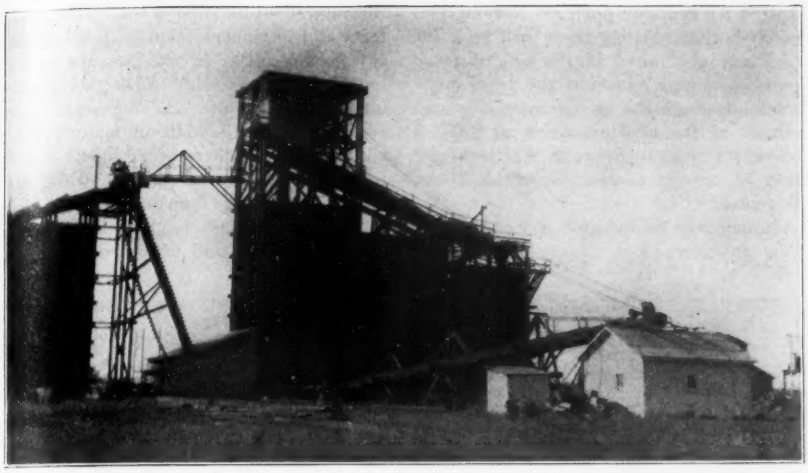


A view from the distance showing the flow of material and the wooden sizing bins

The first drawing shows a plan, side and end view, of the entire plant. The track layout is such as to allow loading


Line
Fuses
Switch
Starter
To Motor
Typical Connections to Motors
110 Volt Lighting line *8 Wires. To Gravel and Rock Plants. (Switch Board in Pump and Crusher House)
3*60 Cycle, 440 Volts Power Line to Pump, Crusher and Gravel and Plants 160 H.P. *4/0 D.B.W.P. Varnid Camb Wire (S Bin Pond C. House
In-coming line from Power Source (412 Amp.) 3 Phase, 60 Cycle, 440 V
To Lights in Hoist House
800 Amp. Oil Circuit Breaker
Meter
300 Amp. Switch
To hoist motor 150 HP
4/0 Wires
Lighting Trans
30 Amp. Switch
10 Amp Fuses
*14 Wires
Arrangement of Power and Lighting Circuits on Switch Board In Hoist House
Starter and 200 Amp. T.P.S.T. Switch Controlling Pump Meter Located Here
To Office
30 HP.
15 HP
100 HP
PLAN
ELEVATION A-A
ELEVATION B-B
To Gravel Plant Sides - Over Spouts
To Gravel Plant Screens, Stairs & Drive Ho.
To Pump and Crusher House
110 Volt Light Feed line from Hoist House *8 Wires
60 Amp. Fuses
60 Amp. Switch
To Office
To Rock Plant Sides - Over Spouts
To Rock Plant Screens, Stairs and Drive House
10 Amp Fuses
30 Amp Fuses
Dead Line
Arrangement of Lighting Circuits on Switch Board in Pump and Crusher House
*10 Wires To Rock Pl. Scr's and Elevator 15 HP.
*6 Wire to Gravel Pl. Scr's
400 Amp. Switch and Fuses
*4/0 Incoming Feed Wires from Hoist Ho.
200 Amp. Fuses
200 Amp. Switch T.P.D.T.
*0 Wires
To & From 200 Amp. T.P.S.T. Sw. in Scr. Drive Ho. at Top of Gravel Plant
*0 Wires
*0 Wires to Pump 100 HP
Starter
*10 Wires 60 Amp. Switch and Fuses To Crusher 15 HP
60 Amp. Switch
60 Amp. Fuses
Dead End
Arrangement of Power Circuits on Switch Board in Pump and Crusher House
Starter and 200 Amp. T.P.S.T. Switch Controlling Pump Motor to be Located here
30 HP.
15 HP.
*0 Wires
*10 Wires
*6 Wires
10 Wires
*4/0 Wires
To Office
*10 Wires
*4/0 Wires
150 HP
100 HP.
15 HP.
*0 Wires
SIDE ELEVATION

Wiring layout of the entire plant showing location of lights and motors—also line diagrams showing distribution of the power from the various switchboards



Close-up view of the gravel screening plant showing crusher house and elevator to crushed stone screening plant

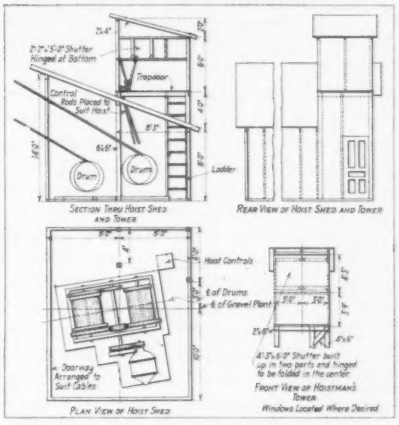
from both sides of the sand and gravel plant and also the crushed stone plant. A siding is also provided to reach both a crushed-stone and a sand and gravel ground storage. The trussed timber mast to which the dragline is attached is supported by six steel guy cables which are anchored to the ground.

The layout of both the crushed-rock and sand and gravel screening and washing plants and the flow of material is shown in side elevations. The sand and gravel is delivered to the hopper above the sand and gravel plant. The screens, which are of the patented Dull type, (made by the Link-Belt Co.), are mounted upon one common shaft and driven by one motor.

Screening and Washing Plant

All of the material enters the initial screen where the material is divided into sand and gravel and crushed-stone. All of the material over 1½ in. is rejected to the crusher. The sand and gravel passes on through the screens and each size is delivered to its respective bin. The flow of the material is clearly evident from these drawings. The screening arrangement consists of four conical rotating screens and a squirrel cage sand screen. The fine sand is washed and separated from the water and dirt by a conical settling box (Dull sand separator).

The material larger than 1½ in. which is rejected from the initial gravel screen is chuted to a jaw crusher and reduced to ¾ in. and less. This is the crushed-stone product. It is elevated by a chain bucket elevator to the crushed-stone sizing plant, where two commercial sizes of crushed-stone are prepared. The rejections of the first crushed-stone screen are rechuted to the jaw crusher. The screens used for the crushed-stone plant

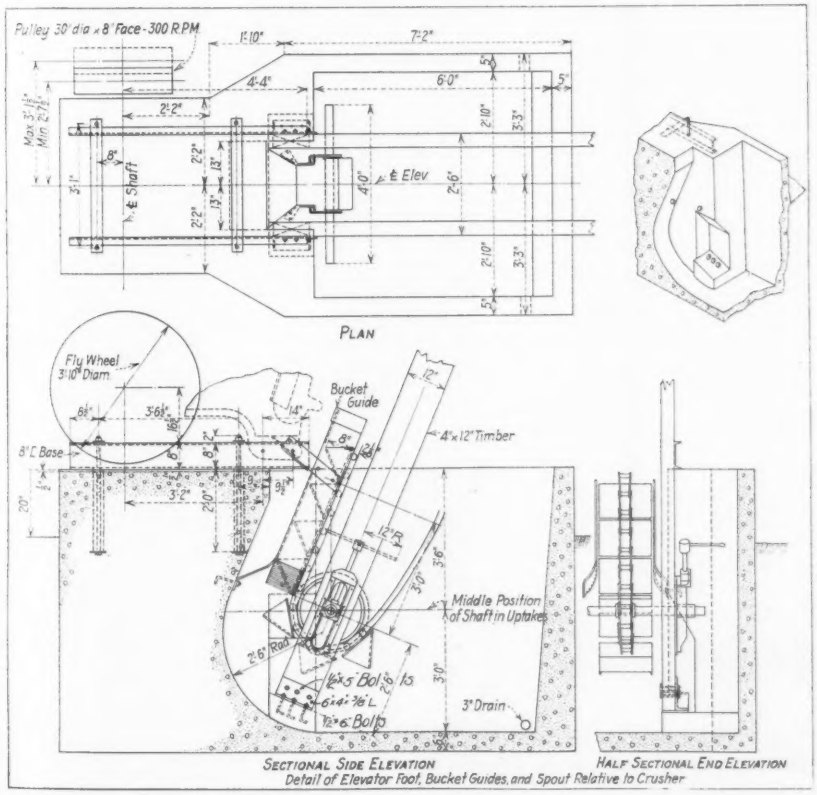


Plan view and a section through the hoist shed showing hoisting drum and motor connection

are identical with those of the sand and gravel plant. The fine crushed sand is collected in a sand box, where the water and any dirt is removed. This is a washed, crushed-sand product. The commercial crushed-stone is also washed as it is sized.

The material flows by gravity through the entire plant with one exception. The jaw crusher is mounted on the ground between the two sizing plants and its product must be elevated a distance of some 50 ft. to the crushed-stone sizing screens.

A detail design of the elevator boot, bucket guides and arrangement of chutes to the crusher is shown. This is a special design which will prevent any spilled stone from accumulating underneath the elevator. At the foot of the elevator the buckets come close to the curved face of a concrete hopper in which the bottom drum of the elevator is located. The discharge chute from the crusher is just above this and any stone which is not directly deposited into the buckets falls into this hopper and is immediately picked up.


Pulley 30" dia. x 8" Face - 300 R.P.M.
Plan
Fly Wheel 3'10" Diam.
Bucket Guide
4"x12" Timber
8" I Beam
Middle Position of Shaft in Uptake
3" Drain
Sectional Side Elevation
Half Sectional End Elevation
Detail of Elevator Foot, Bucket Guides, and Spout Relative to Crusher

Detail of elevator foot, bucket guides, and spout relation to crusher, showing arrangement to prevent spillage of material at elevator foot

Wiring and Power

The electric wiring layout shows the exact location of every wire, motor and light. Line diagrams are also included, providing for the distribution of power to the different drive units. The location of the various motors enables an independent drive of the various units.

Sectional views and details give definite information as to the construction of the storage bins, supports and cross-ties. Special care has been used in safety precautions in that the stairways and places where workmen must pass are provided with plank passageways and handrails.

An abundance of water was insured in the layout of the piping by the use of large water mains to both washing plants. Details of the piping are also included in the side elevation drawings. An 8-in. centrifugal pump supplies 2000 g.p.m. to the washing plant.

A large loading pier will enable shipment by water. A track has been laid down to the river front and the small dinkey engine which will be kept for switching purposes will be used to move loaded cars down to the loading pier.

As has been explained, the plant is entirely electrically operated. The company purchases its power in preference to manufacturing it. The officials of the company are as follows: T. O. Block, president; J. P. Langford, vice-president; George Koenigsaecker, secretary and D. G. Asthalter, general manager.

When the second set of screens which have already been ordered has been installed the Automatic Gravel Products Co. plant will be one of the largest in eastern Iowa.

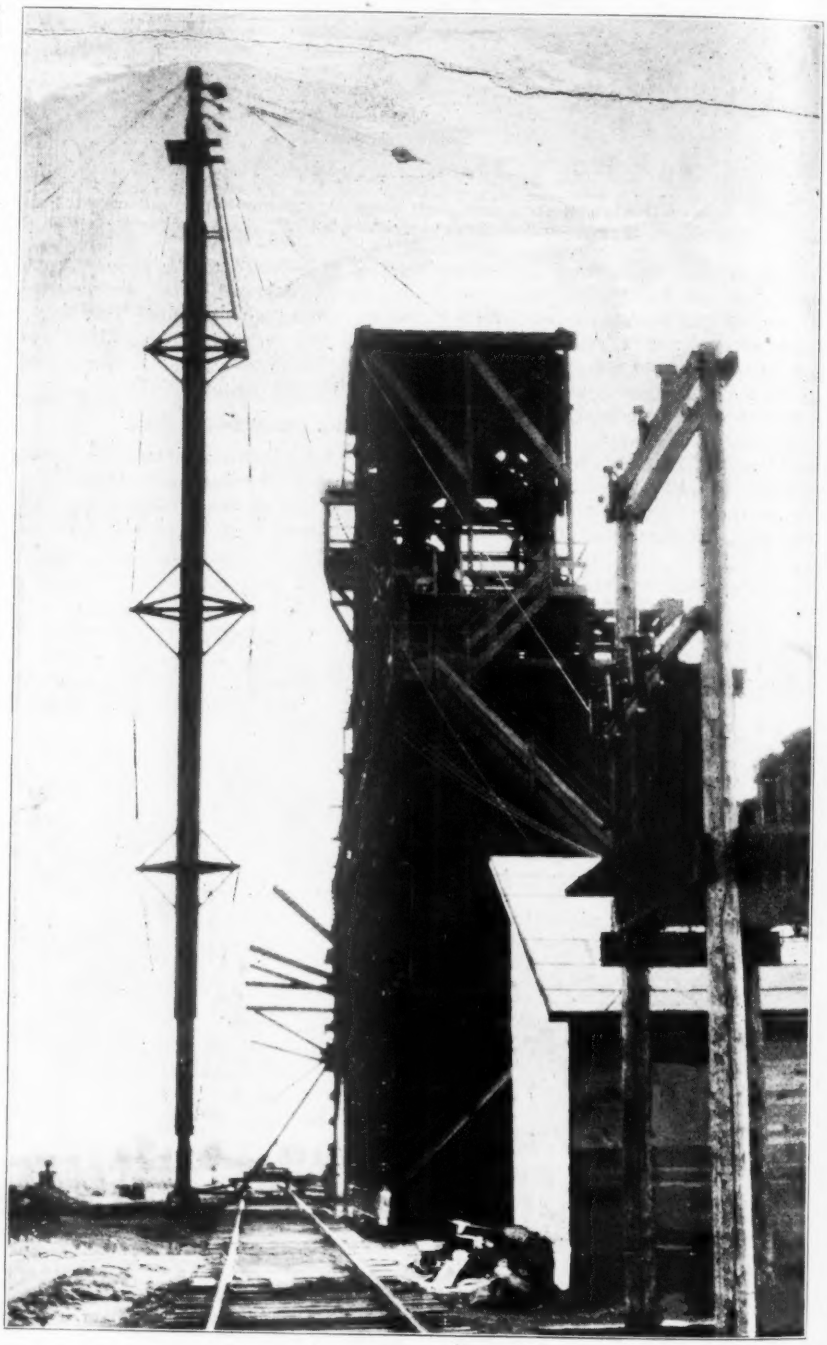
Easing Up of Labor Condition Brightens Eastern Market

THERE IS ALMOST complete harmony in the entire building trades as far as any differences between employers and employes are concerned, according to the Dow Service Daily Building Report. There is a demand for additional help far beyond the supply and efforts are being made to bring back to this city laborers who formerly were employed here but during the long negotiations regarding wages and labor conditions removed to other parts of the country where they obtained ready employment.

There was a slight disturbance among the carpenters and store fixture workers, but it seems that about 70 per cent of the men have returned to affiliations under the control of the American Federation of Labor. This condition, which a few weeks ago, did not seem to be possible for some time, coupled with the slight relief in the supply of building materials gives the building trades assurance that things are on the way toward marked improvement.

Railroad freight charges have been advanced ten cents on portland cement. The result is that possibly there will be a 10-cent advance noted in the official price reports coming out into the trade next week, although the quotations today still remain at the new quotation of $2.50 a barrel. It was apparent at the week end that all cement companies would follow this advance.

It may now be definitely stated that the tide has turned in favor of general resumption of building work. The architects and engineers seem to have sensed this change last week, because many building projects which had been scheduled for indefinite abandonment have come to life. In addition many of the contractors who heretofore have refused to make estimates on building work, are again submitting figures. This is because they can place more dependence upon the supply and fidelity of labor.



Close-up view of the gravel screening plant showing the loading track and the details of the trussed wooden drag-line tower

Equal Strength Concrete from Dissimilar Aggregates*

Table Shows Proportion of Cement Necessary Whereby Almost Any Natural Gravel May Be Used to Produce Equal Strength Concrete

By A. N. Johnson
Consulting Engineer, Portland Cement Association

AGGREGATES having far greater ranges of size than have been considered permissible can be employed for concrete pavement. The concrete mixtures from all will be equally strong and uniformly workable. Proper proportions are all that is necessary. These proportions can be determined in the field by means of tables, which embrace the ranges of sizes and gradings ordinarily exhibited by natural gravels. Great extension by this means of the sources of materials available for concrete road construction is accomplished, and one of the most troublesome problems of the road builder is materially simplified.

Numerous tests conducted by Prof. D. A. Abrams of Lewis Institute, Chicago, have demonstrated that by determining the fineness modulus, it is practicable to make concrete of equal strengths from quite dissimilarly graded materials. For example, one aggregate may range from 3-in. pieces to the finer sand particles, while the second may contain no pieces over 1-in. in size and yet, by varying the proportions of cement, each of these aggregates may be used and the strength of the resulting concrete will be the same.

Present Specifications Exclude Usable Materials

Many supplies of aggregates now excluded by the narrow restrictions of our specifications may be employed and just as good concrete produced as that made under our present specifications. We have been somewhat inclined to develop a standard specification and have lost sight of the fact that it is not the specification that is to be standard, but rather the product. If concrete possessing the same strength and durability can be made from aggregates having various gradings and limiting sizes, then there is no reason to adhere to specifications which confine the selection of aggregates to those of a particular grading and exclude all others.

Under our standard specifications for fine aggregate, we are limited to the use of material varying from ¼-in. size down to the finer materials, specifying that it shall be reasonably well graded between the smaller and larger particles. Suppose, however, there is available a quantity of sand containing no particles larger than ⅛-in., are we to throw away these sands, or may we use them, varying the proportions so as to produce the same strength concrete as is obtained with the sand containing ¼-in. particles?

Our specifications today for coarse aggregate, while they vary somewhat more than for fine aggregate, restrict the choice of materials to very narrow limits, the sizes usually specified varying from ¼ in. to 2 in., some to as high as 3 in. and a number limiting the larger size to 1½ in. But we have at hand, let us say, a large amount of material which contains no particles less than 1 in. in size, varying from that to 2 in. or possibly to 3 in., or there is other material available containing nothing less than ½ in. and perhaps nothing over 1 in. The question is, can we use aggregates, which vary so widely from our present specifications, in such a way as to produce concrete as strong and durable as with the aggregates that comply with our present specifications. From Professor Abrams' work we know the answer to be "yes." Also Professor Abrams has prepared Table I and II which puts the results in a practically available form.

Tables Based on Present Practice

The basis upon which the tables have been calculated is the production of a concrete that experience has shown will have sufficient strength and durability for its purpose. There have been many miles of concrete roads built using a 1:2:3 mixture with the fine aggregate varying from ¼ in. to the finer particles and the coarser aggregate varying from ¼ in. to 1½ in. or 2 in. Such a concrete tested under laboratory conditions, using 6x12 in. cylindrical test specimens, and with a plasticity that secures a practical workability, gives very closely at 28 days a compressive strength of 3,000 lbs. per square inch. This was taken as a basis upon which the tables have been prepared.

Five different fine aggregates were selected, varying, as the table will indicate, from the finest which contains no particles over 1/28-in. and others not over 1/14, ⅛, ¼ and ⅜ in. in size, respectively. A wide selection of coarse aggregates is given, beginning with the first group which has the smaller limit of size at ¼ in., while the larger limit varies from ¾ in. to 3 in. In the second group the lower limit for the coarse aggregate is ⅜ in., with sizes for the upper limit varying from ¾ in. to 3 in. Similarly there are groups with the lower limit at ½ in., ¾ in. and 1 in., respectively, the upper limits in each group varying in sizes to 3 in., making in all 27 variously sized coarse aggregates, each in turn combined with five different fine aggregates or sands, thus making 135 combinations of fine and coarse aggregates each of which is proportioned so as to produce under practical working conditions as to consistency the same strength concrete.

In all cases it is to be assumed that all aggregates that are to be used, irrespective of size or grading, are to be of material structurally sound, clean and free of organic impurities. Also it should be observed that Professor Abrams' tests demonstrated that the resistance to abrasion of concretes varied as the compressive strength, the greater the strength the greater the resistance to wear; and that concretes of equal crushing strength gave about equal resistance to abrasion.

In the practical application of the tables we first have to define how to determine what is the upper limit of size for a given aggregate. Should any sand containing a few ¼-in. particles be classed as one varying from zero to ¼ in., or should there be required a certain percentage of material between the ¼-in. size and the next lower limit, as shown in the table, which is ⅛ in.? The proper allowance, Professor Abrams tells us, should be 15 per cent; that is, a fine aggregate with ¼-in. particles which did not contain 15 per cent by volume of the material passing the sieve with eight openings to the inch, should be classed as ⅛-in. sand, not ¼-in.

The following rule is to be applied to

*A method of applying fineness-modulus theory of proportioning concrete to actual field use in concrete highway construction as outlined in addresses before the American Road Builders Association and various state and local engineering societies in the May 13, 1920, issue of The Engineering News-Record.

determine the limits of sizes for the coarse aggregate: There shall be not less than 10 per cent of material between the largest size and the next smallest size shown in the table. Thus a coarse aggregate to be classed as 2½-in. size shall have not less than 10 per cent of the material between the 2½-in. size and the 2-in. size it should be classed as 2-in., providing there should be at least 10 per cent of the material retained upon the 1½-in. screen.

The lower limit of size of a coarse aggregate shall be the largest size shown in the table for coarse aggregate below which there is not to exceed 10 per cent by volume of the material. Thus a coarse aggregate in which the lower limit of size is to be 1 in. should be an aggregate in which there is not to exceed 10 per cent by volume of the material passing the 1-in. screen. In all coarse aggregates if there is to exceed 5 per cent of the volume passing a ¼-in. sieve, then such excess shall be considered as fine aggregate and the amount of fine aggregate to be used is to be modified accordingly.

It will be noted that in addition to the proportions regulating the combination of the various fine and coarse aggregates with the unit quantity of cement, there is also given in the tables the quantities of the materials to be used to make 1 cu. yd. of concrete. These quantities are in barrels and hundredths of barrels for cement and in hundredths of cu. yds. for the aggregates.

It will be supposed that one sand is that usually specified, from ¼ in. down, and must be shipped in at a cost of $2 per cu. yd.; that one coarse aggregate, varying from ¼ in. to 2 in., must also be shipped in at a total cost of $3 per cu. yd.; that there is available locally a supply of sand and coarse aggregate, each being rather fine, the sand varying from ⅛ in. down, which costs $1.50 per cu. yd., while the coarse aggregate varies from ¼ in. to 1 in. and may be secured at a cost of $2.50 per cu. yd. The cement in each case is assumed to cost $3 per barrel. The cost of a cu. yd. of concrete using the materials to be shipped in would then be as follows:

1.52 bbl. cement at $3	$4.56
0.43 cu. yd. of sand at $2	0.86
0.81 cu. yd. of coarse aggregate at $3	2.43
Total cost of 1 cu. yd. concrete	$7.85

Using local materials the cost would be:

1.72 bbl. cement at $3	$5.16
0.46 cu. yd. of sand at $1.50	0.69
0.66 cu. yd. of coarse aggregate at $2.50	1.65
Total cost of materials for 1 cu. yd. conc.	$7.50

In this instance the local aggregate, although fine and requiring more cement, will produce a yard of concrete at less cost. In general, it will be found that the use of finer sand or of finer aggregate increases the amount of cement, the opposite being true for coarser sizes. Thus a coarse aggregate with all of the fine material removed, varying from 1 in. to 3 in. in size, combined with sand varying from ¼ in. down, uses 1.49 bbl. of cement; whereas an aggregate varying from 1 in. to ¼ in. combined with the same sand, ¼ in. down, requires 1.67 bbl. of cement for a cu. yd. of concrete.

If the producer of aggregate materials can say what are the sizes of aggregates he can furnish, they can be used to make a concrete of a given strength. Should concrete of a strength other than 3,000 lb. per square inch be desired, then another table would be calculated with the proportions and quantities required accordingly; but the table given here is confined to the use of concrete for concrete roads where a 3000-lbs. per sq. in. quality is required.

SIZES		FINE AGGREGATES, SCREEN OPENINGS PER INCH														
COARSE AGGREGATES Inches	Cement to Barrels Aggregates in Cubic Yards	0-28			0-14			0-8			0-4			0-⅜ in.		
		Cement	Fine	Coarse	Cement	Fine	Coarse	Cement	Fine	Coarse	Cement	Fine	Coarse	Cement	Fine	Coarse
No. 4 Screen to ¾	Proportions	1	1.3	2.4	1	1.6	2.4	1	1.8	2.3	1	2.0	2.3	1	2.7	1.5
	Quantities	1.96	.37	.69	1.85	.44	.66	1.82	.48	.62	1.75	.52	.59	1.79	.72	.40
No. 4 Screen to 1	Proportions	1	1.3	2.7	1	1.6	2.6	1	1.8	2.6	1	2.0	2.5	1	2.6	1.8
	Quantities	1.90	.36	.76	1.77	.42	.68	1.72	.46	.66	1.67	.50	.62	1.72	.66	.46
No. 4 Screen to 1½	Proportions	1	1.2	3.1	1	1.6	3.2	1	1.7	3.1	1	2	3	1	2.4	2.4
	Quantities	1.82	.32	.84	1.68	.40	.79	1.63	.41	.75	1.61	.47	.72	1.62	.57	.57
No. 4 Screen to 2	Proportions	1	1.2	3.5	1	1.5	3.5	1	1.6	3.7	1	1.9	3.6	1	2.2	3.1
	Quantities	1.75	.31	.90	1.63	.36	.85	1.55	.36	.85	1.52	.43	.81	1.53	.50	.70
No. 4 Screen to 2½	Proportions	1	1	3.8	1	1.4	3.9	1	1.6	4.0	1	1.8	4.0	1	2.1	3.5
	Quantities	1.72	28	.97	1.58	.33	.91	1.51	.35	.89	1.49	.40	.88	1.50	.46	.78
No. 4 Screen to 3	Proportions	1	1.1	3.9	1	1.4	4.1	1	1.5	4.1	1	1.7	4.1	1	2.0	3.7
	Quantities	1.69	.28	.97	1.58	.33	.97	1.49	.33	.90	1.49	.37	.90	1.49	.44	.81
⅜ to ¾	Proportions	1	1.3	2.3	1	1.7	2.3	1	1.9	2.3	1	2.2	2.2	1	2.8	1.4
	Quantities	1.96	.37	.67	1.85	.46	.63	1.82	.51	.62	1.75	.57	.57	1.79	.75	.37
⅜ to 1	Proportions	1	1.3	2.6	1	1.7	2.6	1	1.9	2.5	1	2.2	2.4	1	2.7	1.7
	Quantities	1.90	.36	.74	1.77	.44	.68	1.72	.48	.64	1.67	.54	.59	1.72	.68	.43
⅜ to 1½	Proportions	1	1.3	3.0	1	1.7	3.0	1	1.9	3.0	1	2.1	2.9	1	2.6	2.2
	Quantities	1.82	.35	.80	1.68	.43	.75	1.63	.46	.73	1.61	.50	.68	1.62	.63	.53
⅜ to 2	Proportions	1	1.3	3.3	1	1.7	3.4	1	1.8	3.5	1	2.0	3.4	1	2.4	2.9
	Quantities	1.75	.34	.86	1.63	.41	.83	1.55	.42	.80	1.52	.45	.77	1.53	.62	.66
⅜ to 2½	Proportions	1	1.3	3.7	1	1.6	3.7	1	1.7	3.9	1	2.0	3.8	1	2.3	3.3
	Quantities	1.72	.33	.95	1.58	.37	.87	1.51	.37	.87	1.49	.44	.84	1.50	.51	.74
⅜ to 3	Proportions	1	1.2	3.8	1	1.6	3.9	1	1.7	4.0	1	1.9	4.0	1	2.2	3.5
	Quantities	1.68	.30	.95	1.58	.37	.91	1.49	.37	.88	1.49	.42	.88	1.49	.48	.77
½ to ¾	Proportions	1	1.5	2.3	1	1.9	2.2	1	2.1	2.2	1	2.3	2.1	1	2.8	1.3
	Quantities	1.96	.44	.67	1.85	.52	.61	1.82	.56	.59	1.75	.59	.54	1.79	.75	.34
½ to 1	Proportions	1	1.5	2.5	1	1.9	2.5	1	2.1	2.4	1	2.3	2.4	1	2.8	1.6
	Quantities	1.90	.42	.70	1.77	.50	.66	1.72	.53	.61	1.67	.57	.59	1.72	.72	.41

SIZES		FINE AGGREGATES, SCREEN OPENINGS PER INCH														
COARSE AGGREGATES Inches	Cement to Barrels Aggregates in Cubic Yards	0-28			0-14			0-8			0-4			0-⅜ in.		
		Cement	Fine	Coarse	Cement	Fine	Coarse	Cement	Fine	Coarse	Cement	Fine	Coarse	Cement	Fine	Coarse
½ to 1½	Proportions	1	1.4	2.8	1	1.9	2.9	1	2.1	2.9	1	2.2	2.8	1	2.7	2.1
	Quantities	1.82	.37	.75	1.68	.47	.73	1.63	.51	.69	1.61	.52	.66	1.62	.65	.51
½ to 2	Proportions	1	1.4	3.3	1	1.9	3.3	1	2.0	3.4	1	2.2	3.3	1	2.7	2.7
	Quantities	1.75	.36	.86	1.63	.46	.79	1.55	.46	.78	1.52	.50	.74	1.53	.62	.62
½ to 2½	Proportions	1	1.4	3.6	1	1.8	3.6	1	1.9	3.7	1	2.1	3.7	1	2.6	3.1
	Quantities	1.72	.35	.91	1.58	.43	.85	1.51	.42	.83	1.49	.46	.81	1.50	.57	.69
½ to 3	Proportions	1	1.3	3.7	1	1.8	3.8	1	1.8	3.9	1	2.1	4.0	1	2.4	3.3
	Quantities	1.68	.33	.92	1.58	.42	.89	1.49	.40	.86	1.49	.46	.88	1.49	.53	.63
¾ to 1	Proportions	1	1.7	2.4	1	2.1	2.4	1	2.4	2.1	1	2.6	2.2	1	3.1	1.5
	Quantities	1.90	.48	.68	1.77	.55	.63	1.72	.61	.53	1.67	.64	.55	1.72	.79	.39
¾ to 1½	Proportions	1	1.7	2.7	1	2.0	2.8	1	2.3	2.7	1	2.5	2.7	1	3.0	2.0
	Quantities	1.82	.46	.73	1.79	.50	.70	1.63	.55	.65	1.61	.59	.64	1.62	.73	.48
¾ to 2	Proportions	1	1.7	3.1	1	2.0	3.1	1	2.3	3.1	1	2.5	3.0	1	3.0	2.4
	Quantities	1.75	.44	.80	1.63	.48	.75	1.55	.53	.72	1.52	.56	.67	1.53	.68	.55
¾ to 2½	Proportions	1	1.7	3.3	1	2.0	3.5	1	2.3	3.4	1	2.4	3.4	1	2.9	2.8
	Quantities	1.72	.43	.84	1.63	.47	.83	1.51	.52	.76	1.49	.53	.75	1.50	.64	.62
¾ to 3	Proportions	1	1.7	3.5	1	2.0	3.7	1	2.3	3.7	1	2.4	3.6	1	2.8	3.1
	Quantities	1.68	.43	.88	1.58	.47	.87	1.49	.51	.81	1.49	.53	.79	1.49	.62	.68
1 to 1½	Proportions	1	1.7	2.8	1	2.0	2.9	1	2.3	2.7	1	2.6	2.6	1	3.1	2.0
	Quantities	1.82	.46	.75	1.68	.50	.73	1.63	.55	.65	1.61	.62	.62	1.62	.75	.48
1 to 2	Proportions	1	1.5	3.2	1	1.9	3.5	1	2.2	3.3	1	2.4	3.3	1	3.0	2.6
	Quantities	1.75	.39	.83	1.63	.46	.85	1.58	.51	.76	1.52	.54	.74	1.53	.68	.59
1 to 2½	Proportions	1	1.4	3.4	1	1.9	3.8	1	2.0	3.7	1	2.3	3.7	1	2.7	3.1
	Quantities	1.72	.35	.86	1.58	.45	.89	1.51	.44	.83	1.49	.51	.81	1.50	.59	.69
1 to 3	Proportions	1	1.3	3.6	1	1.8	4.0	1	2.0	3.9	1	2.2	3.9	1	2.7	3.3
	Quantities	1.67	.33	.90	1.58	.42	.94	1.49	.44	.86	1.49	.48	.86	1.49	.59	.73

Based upon laboratory investigations, using approved materials. Compressive strength, 28 days, with workable plasticity, 9 x 12 in. cylinders, 3,000 lb. per square inch.

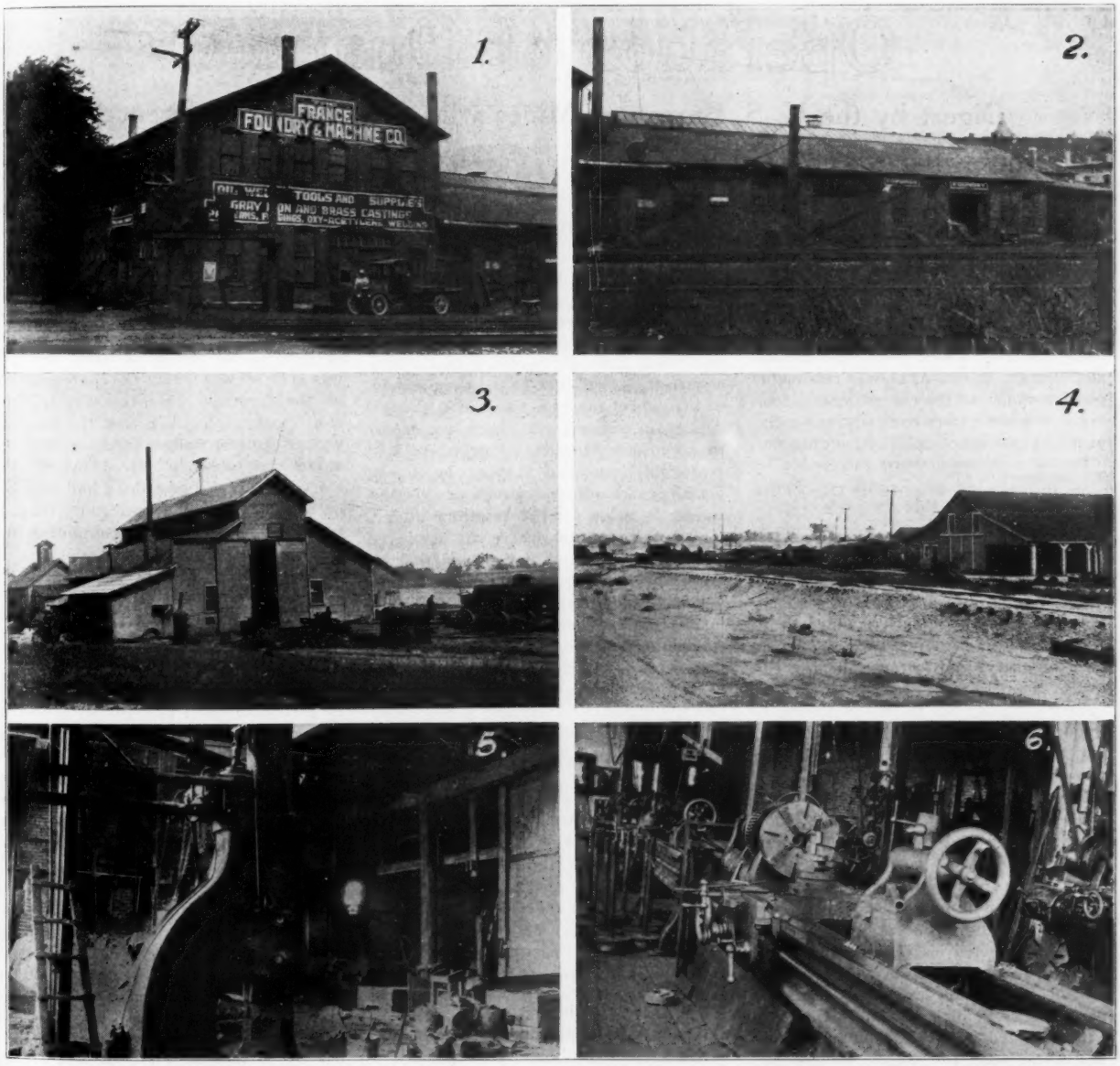
Proportions and quantities of aggregate per cu. yd. of 3000-lb., 28-day concrete

Large Ohio Quarry Operator Has Complete Repair Department

The France Stone Co. Operates Machine Shop, Foundry and Keeps Stock House and Yard for Emergency

AN EXTENSIVE scope of operation has made it possible for the France Stone Co. to build up a complete and separate repair department. This department is headed by the master mechanic, who is responsible for the repair of machinery at all plants. Under his direct supervision there is a boiler shop, a car-repair shop, a stock yard and building, and the repair forces. The machine shop and foundry work is in direct conjunction with the repair department, but under a separate head.

Where so many plants are operated by one organization, it has been found to be of great advantage to carry on hand at all times quite a large supply of repair parts and machinery. In event that a plant has a breakdown, which will require a new



(1) Machine shop. (2) Foundry. (3) Boiler and car repair shop. (4) Spare part yard and stock building. (5) Steam hammer and interior of foundry. (6) Interior of machine shop

part or even a new machine, such as a motor, its needs are immediately communicated to the head office at Toledo, where a complete record of supplies on hand is kept. If the part required is in stock it is immediately sent out from the North Baltimore shops.

A two-ton truck is kept at the machine shop, and if the part is very badly needed and the haul is not too long, it is made by this motor truck. By keeping a large variety of spares and with this quick method of delivery, it has been found that often a quick replacement will save several days' shut down.

When a plant draws on the warehouse for supplies it is charged with its purchase at a lower price, however, than if it had made the purchase in the open market. When a broken part or machine is turned in, the plant is credited with its value, and men are put to work getting it ready for use again. It is a rule that all discarded parts be turned in to the warehouse, and several times it has been found that things which have lost their usefulness at one plant are of value at another.

The boiler and car repair department overhauls and rebuilds cars and boilers and makes shovel dippers. Where wooden cars are to be used at a quarry, their life is materially added to by reinforcing with steel bands bolted around the edge and across the bottom of the white oak beds.

The machine shop and foundry are in themselves a complete department. Castings are made, and all parts not carried in stock, are finished. Several interior views of these shops will give an accurate idea of the extent of their work. Since they are much larger than is required by the repairs of the France Stone Co., they do considerable job work for other plants in the neighborhood.

Recent Court Decisions on the Operation of Quarries

Digest by the U. S. Bureau of Mines with Law Report References

THE FOLLOWING DECISIONS of various courts involving quarry operation cover many points of interest and value to all quarry men:

Failure to Furnish Medical Aid

It is the duty of a quarry operator in an emergency created by an accident to render to an injured employe such immediate first aid, as well as prompt medical and surgical attention, as was reasonably possible under all the circumstances. Failing in this the quarry company was guilty of negligence in not using active diligence.

Hunicke v. Meramec Quarry Co., — Mo. —, 212 Southwestern 345.

See Hunicke v. Meramec Quarry Co., 262 Mo. 560, 172 Southwestern 43.

Negligence of Operator—Horses Frightened by Blast

It was actionable negligence for a quarry operator to fire blasts in a quarry without warning in such manner as to frighten a team of horses properly driven into the quarry and to cause them to run away. Under these circumstances the quarry company was liable for injuries to the driver received while he was attempting to prevent the team from running away.

Slinkard v. Lamb Construction Co., — Mo. App. —, 212 Southwestern 61, p. 64.

Negligence of Foreman—Liability of Operator

A granite quarry operator assumed the duty of determining the stability of the pieces of granite in his quarry upon which he directed his employes to work. Having assumed this duty the operator is liable at common law for its negligent performance by his foreman, to whom he had entrusted it, and an employe would not be at fault for failing to ascertain whether the operator had performed this duty.

Tierney v. New England Granite Works, — New Hampshire —, 106 Atlantic 481, p. 842.

Employe Obeying Instructions—Knowledge of Danger—Recovery

An employe in a quarry was injured while inserting with his hands a wedge beneath a stone in obedience to the directions of the foreman. The injury occurred in Pennsylvania and the statute of that state expressly provides that where a servant in obedience to the requirement of the master incurs a risk which, though dangerous, is not so much so as to threaten immediate danger or where it is reasonably probable it may be safely done by extraordinary caution or skill, the master is liable for the resulting injury. Under this statute, where an employer gives an employe to understand that he does not consider a particular act one which a prudent person should refuse to undertake, the employe has a right to rely upon his master's judgment unless his own is so clearly opposed thereto that in fact he does not rely upon his employer's opinion. A servant is not called upon to set up his own judgment against that of his superiors, and he may rely upon their advice and still more upon their orders notwithstanding any misgivings of his own. The employe's dependent and inferior position is to be taken into consideration; and if the employer gives him positive orders to go on with the work under perilous circumstances the employe may recover for an injury thus incurred if the work was not inevitably and imminently dangerous.

Fillippon v. Albion Vein Slate Co., 39 Supreme Ct. Rep. 435, p. 437.

Contributory Negligence—Question of Fact

An experienced quarryman was directed by the foreman to prepare a piece of granite for the attachment of chains so that it could be removed by a derrick. It was the foreman's duty to see that the stone was on a secure foundation before directing the workman to split off a piece because of a seam. The workman did split off a piece and was injured while preparing the remainder for removal by the derrick. The work of continuing the preparation of the block after the part was split off was within the contemplation of the foreman when he directed the stone to be split. Whether the foreman was at fault in not ascertaining that the stone was securely placed for all the work necessary to be done and whether or not the workman was guilty of contributory negligence in continuing the work upon the stone were questions of fact to be determined by the jury.

Tierney v. New England Granite Works, — New Hampshire —, 106 Atlantic 481, p. 482.

Action for Personal Injury—Instructions in Absence of Parties

An employe in a stone quarry known as a rubbish hand brought an action to recover for injuries caused by the fall of a stone while he was pushing a wedge under the stone in the presence of and under the express direction of the foreman. After the evidence was heard and the instructions given the jury retired for deliberation and later the jury submitted to the judge a query as to whether or not the plaintiff was guilty of contributory negligence in pushing the wedge under the stone. The judge in answer to the inquiry, and in the absence of the parties and their attorneys, sent to the jury a general instruction to the effect that if the plaintiff appreciating the danger and in obedience and in spite of the dangers known to him pushed the wedge under the stone with his hands, he was

guilty of contributory negligence. The court had no right or business in the orderly trial of a case so to instruct or direct the jury while absent from the court and in the absence of the parties and their attorneys.

Fillippon v. Albion Vein Slate Co., 39 Supreme Ct. Rep. 435, p. 436.

Exercise of Care—Freedom From Fault

An employe of a coal company was engaged in delivering a wagonload of coal to a quarry company at its quarry. While engaged in unloading the coal the quarry operators in the line of their work fired a blast that frightened the horses attached to the coal wagon and caused them to start to run away. The employe, in attempting to stop the team, received injuries for which he sued. He was not chargeable with such contributory negligence as to defeat his action, because, instead of taking hold of the lines to stop the team, he ran by the side and endeavored to stop the horses by the bridles. He was not a volunteer, but was acting in the line of his duty. His employment necessarily carried with it the duty on his part to protect the team and wagon from injury and if, in the light of the situation, an ordinarily careful and prudent man in charge of a team of horses belonging to his employer would have acted in a like manner, then the employe can not be held as a matter of law to have been guilty of contributroy negligence, although his attempt to control the team in point of fact resulted in injury to himself.

Slinkard v. Lamb Construction Co., — Mo. App. —, 212 Southwestern 61, p. 64.

The owner of a quarry and rock crusher kept for use dynamite, fuses and dynamite caps. The quarry and crusher were upon the rugged side of a hill and the dynamite, fuses and caps were kept in a box some four feet high with the word "dangerous" printed thereon. The box containing the dynamite and caps was accessible from a path leading up the hill and it was known by the owner that children lived near and were accustomed to pass along the path and to gather about the quarry and crusher. A boy six years old held the lid of the box open with a piece of flooring board and another boy twelve years old reached into and took out the fuses and caps, and in playing with the fuses and caps the six-year-old boy was injured. Under these circumstances the case was not regarded as coming within the doctrine of attractive nuisance.

Gochenour v. Brown, — Kan. —, 180 Pacific 776.

Unexploded Shots—Liability

A quarry operator is liable to a workman for injuries caused by an unexploded shot left by a former shift that was working under an employe to whom superintendence had been entrusted.

Alabama Fuel & Iron Co. v. Smith, — Ala. —, 82 Southern 30, p. 31.

Marble in Guatemala

THE AMERICAN CONSUL at Gautemala City reports that the Guatemala Marble Mining Company is preparing to operate a marble quarry about 13 miles from the railroad station of Zacapa, which station is a little over 100 miles from Puerto Barrios, the nearest port from which the product may be shipped. The deposit is extensive, and though somewhat broken up in places, great quantities of sound marble are available.

Access to the quarry by rail is obtained by a spur track of the International Railways of Central America (Ferrocarril Internacional de Centro America) from Marmol, 3 miles south of Zacapa. This spur is about 5 miles long and terminates at the foot of the mountains. A double-track incline cable-way 2000 ft. in length has been constructed to bring the marble down the mountain. From the top of the incline to the quarry there is a railway six miles in length over which the rock will be hauled by two side-geared Shay locomotives.

A hydro-electric plant, laborers' houses, warehouses, workshops and other buildings necessary for quarry operation are already built. A ten-gang marble sawing mill is now in process of erection under the superintendence of two marble workers from Rutland, Vermont. It is claimed that over a million dollars have been expended in connection with the enterprise.

Shipments up to the present time consist of only one sample consignment of fourteen tons to England, but it is believed that production on a considerable scale is about to begin. A steamer has been secured and arrangements made for shipment of the marble to New York City. (Oliver Bowles in U. S. Bureau of Mines Reports of Investigations.)

Admixture of Lime in Concrete Permitted in New York

ONE of the most important and far-reaching decisions to hydrated lime producers during recent years is expressed in the ruling made by the Board of Standards and Appeals of New York City on April 19, 1920.

Many experienced engineers and contractors have long felt that the building codes of all cities should officially recognize the value of admixtures of hydrated lime in concrete construction, the practical value of which has been repeatedly demonstrated by results in the field.

This matter came before the Greater New York Board as an appeal for a ruling touching the specification for hydrated lime in the concrete work on a large building in that city. After holding numerous hearings and securing testimony from all available sources the board adopted the following ruling:

"The use of hydrated lime in all classes of concrete construction shall not be prohibited when used in accordance with the condition hereinafter set forth.

"The hydrated lime shall conform with the standard specifications for this material which have been adopted by the American Society for Testing Materials.

"The maximum amount of hydrated lime which may be used shall conform with the following table, all weights given being the amount of lime which may be incorporated for each 95-lb. bag of portland cement used.

1-1½-3 mix; 4 lbs. hydrated lime per bag
1-2 -4 mix; 5 lbs. hydrated lime per bag
1-2½-5 mix; 6 lbs. hydrated lime per bag

"For hand mixed concrete, the hydrated lime and portland cement shall be well mixed while dry.

"Hydrated lime shall not be used in concrete which is to be deposited under water."

This decision is a clear-cut recognition, from an authoritative source, of the fact that the addition of hydrated lime in general concrete construction has definite advantages for certain purposes. Bulletin 302, entitled "Improving Cement Products," issued by the National Lime Association, deals with practical considerations of this character.—National Lime Association Report.

Rates on Stone

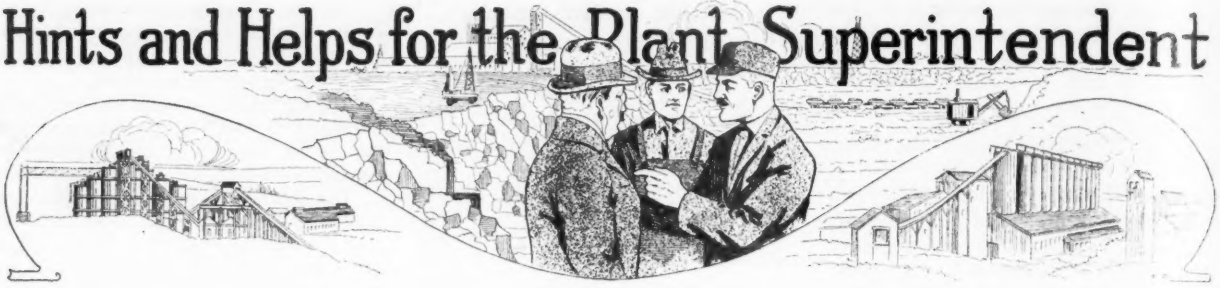
IN A TENTATIVE report on No. 11158, Dewey Portland Cement Co. vs. A. T. & S. F. et al., Examiner, F. H. Barclay, of the Interstate Commerce Commission, recommended a holding that the rates on natural stone or grinding pebbles, carloads, from Golden, Wiggington, Mt. Olivet and Arvada, Colo., to Dewey, Okla., had not been shown to be unreasonable in the past, but that they would be unreasonable for the future to the extent that they exceeded 28 cents per 100 pounds. He recommended a finding that the rates on the same commodity from Pueblo and Denver to Dewey had not been shown to be unreasonable or otherwise unlawful.

Production of Fuller's Earth

FULLER'S EARTH obtains its name from its original use in fulling cloth, but only a little domestic earth is now used in this country for that purpose. It is used principally in bleaching and in clarifying or filtering fats, greases, and oils. It is also used in the manufacture of pigments for printing fall papers, in detecting certain coloring matters in some food products, and as a substitute for talcum powder.

About 75,000 tons of fuller's earth are produced annually in the United States. —United States Geological Survey.

Hints and Helps for the Plant Superintendent



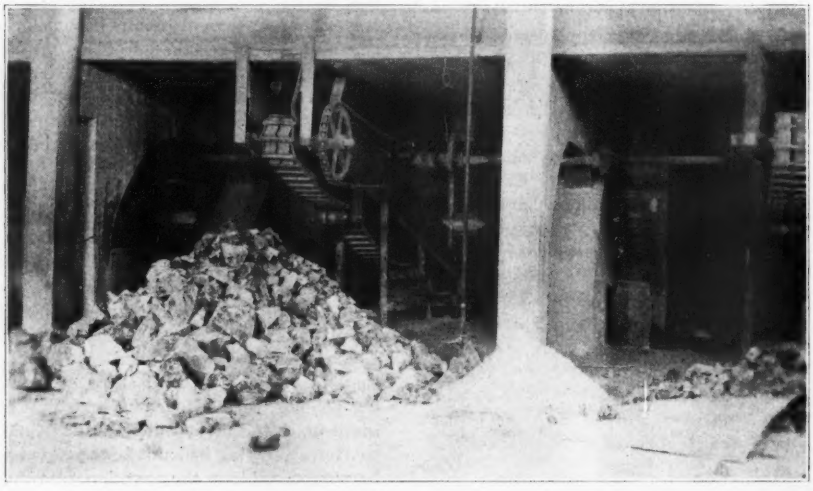
Automatic Handling of Lime on Cooling Floor

LIME is conveyed from the kiln to the storage bins at the Gager Lime Co. plant at Sherwood, Tenn., without hand labor. This company operates 16 vertical kilns which are all mounted in one straight row. All kilns discharge onto one large concrete cooling floor.

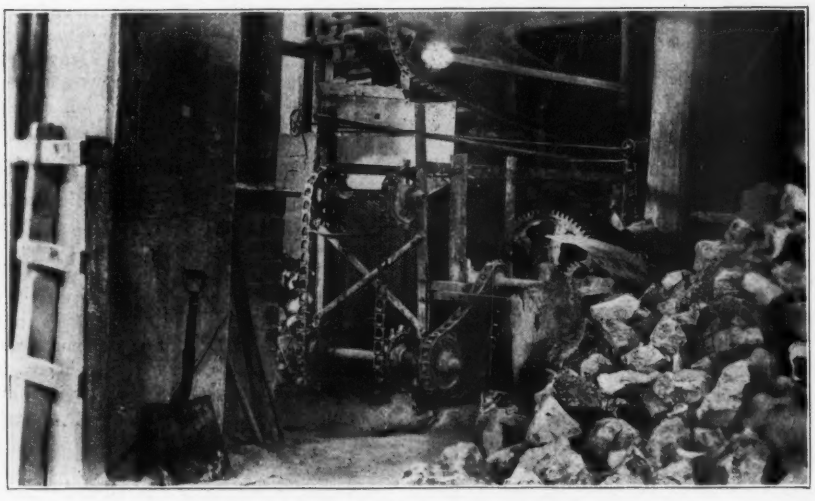
Each kiln is equipped with a 25-ft. conveyor for the hot lime, and when drawing a kiln this conveyor delivers the material to the cooling floor, where it is deposited over a steel pan conveyor. By opening a gate in the floor, the lime is fed into this conveyor and is delivered to the crusher. The hot lime conveyor and the cooling floor are shown in one of the views and the method of handling lime at the crusher is shown in the second.

As the steel pan conveyor approaches the crusher it is inclined above the floor level so as to deposit the lime at the side of the crusher. The lime is fed into the crusher by a chain drag conveyor.

All of the lime of this plant is crushed to ¾ in. and less. This product after having gone through the crusher is elevated from the cooling floor to bins and the hydrators.



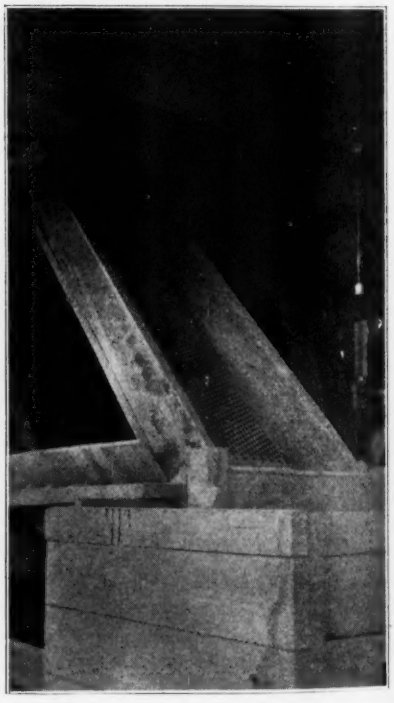
Hot lime conveyor and cooling floor



Chain conveyor to deliver lime to crusher

Insuring Clean Commercial Stone

THE LADD LIME & STONE CO., Cartersville, Ga., in common with many other crushed-stone operators, has in the past had considerable difficulty in getting its commercial stone absolutely clean. In addition to other methods a special precaution by way of a small screen chute was put in between the unloading gate and the belt to the storage or cars. It is found that this screen will remove all fine dust and dirt, thus insuring that the final product will be absolutely clean.



Screen chute underneath the unloading gate

Capacity of a 10-Inch Sand Pumping Plant

"AS TO THE CAPACITY that can be obtained with a 10-in. sand and gravel pump, we have not had but one case for several years when we had cars come together at one time, and the switch engine to come at just the right hour to enable us to develop the largest day's run at full capacity so that we might know what we really could do.

"We loaded 56 cars, 52 of which were of 100,000-lbs. capacity. Their scale weight showed an average of a little over 51 tons to the car, and the 4 cars of 80,000-lbs. capacity showed an average of a little over 42 tons to the car.

"This was 7 hours' continuous operation, picking the material up at an average of 20 to 25 ft. below water and transporting it 600 ft. through the pipe line and making a raise to 30 ft. above water at the other end of the pipe line. We have made a good many runs of one car at a time that were at a higher rate per hour than that, but that is the only opportunity we ever had to do anything like a full day's run."—R. SNODDY, Manager, Coon River Sand Co., Des Moines, Iowa, at the annual convention of the National Association of Sand and Gravel Producers.

Storing Limestone Screenings for Agricultural Use

A CHEAP AND CONVENIENT ground storage arrangement for collecting agricultural limestone screenings during the slack season is in use at the plant of the Chickamauga Quarry & Construction Co., Chickamauga, Tenn.

When the small car-loading bin is filled and no cars are to be loaded the fine screenings are conveyed to a chute which delivers the material to a near-by storage pit.

A derrick and steam-operated hoisting engine is provided to load the cars from this storage. The radius of the derrick and the size of the storage pit enable considerable material to be stored.

How to Turn a Caterpillar Shovel or Dragline in Its Own Length

IT IS NO TRICK at all to turn a caterpillar mounted revolving shovel or small dragline in less than its own length. The following is a good method to employ.

Unless on hard ground, throw plank under the off caterpillar. Take a block, preferably about 14 in. high, and set it against the treads of the caterpillar on the rear corner. That is, if you were intending to turn to the left, set it diagonally against the left forward corner of the left caterpillar, which is not driving. The block should be at least 14 inches high.

As she turns, keep throwing plank under the off caterpillar. On good ground you can kick around as fast as you can throw planking, and on hard ground no planking is required, but where the bottom is soft or muddy the material will pile up against the off side of the off caterpillar. One way to get around this is to drive ahead with both caterpillars far enough to clear and repeat.

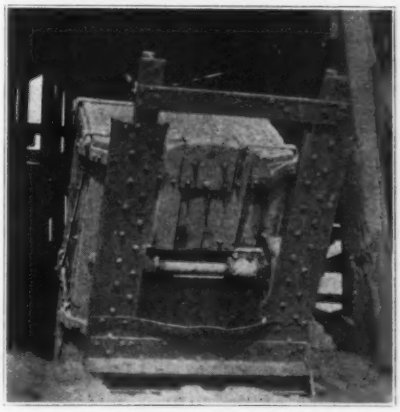
There is one precaution to be observed here. When turning the caterpillar on soft ground, as above described, heavy stresses will come on the brackets and tumblers of the caterpillars because the links are plowing through the ground.

Consequently, it is preferable when turning on soft or muddy ground to turn as an automobile is turned in a cramped place, by a series of zig zag movements. —From the "Excavating Engineer" for March, 1920.

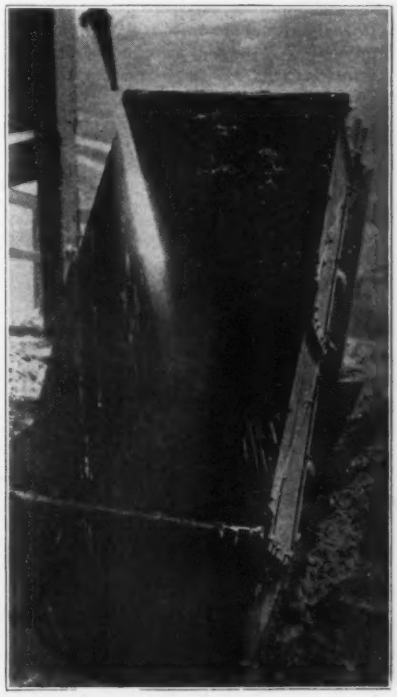
Tipping Car Dumper

THE ACCOMPANYING VIEWS show how the International Agricultural Corporation, whose main offices are at Columbia, Tenn., and whose plant and several phosphate mines are near Mt. Pleasant, removes the phosphate matrix from the mine cars at the washing plant.

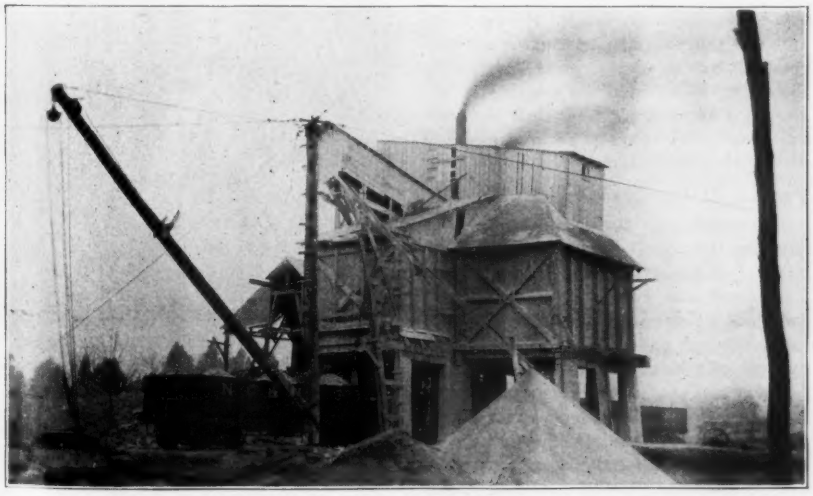
The cars are drawn up an incline by a hoisting engine and cable. At the top of the incline is an end tipping car dumper so that the weight of the car causes the dumper to drop. The front wheels are caught so that the car cannot run into the washing screen and the material is washed out with a heavy stream of water. The water line not only clears the car but gives the material its first washing.



Car in dumping position



Washing out the phosphate



Agricultural limestone storage at Chickamauga Quarry and Construction Co. plant

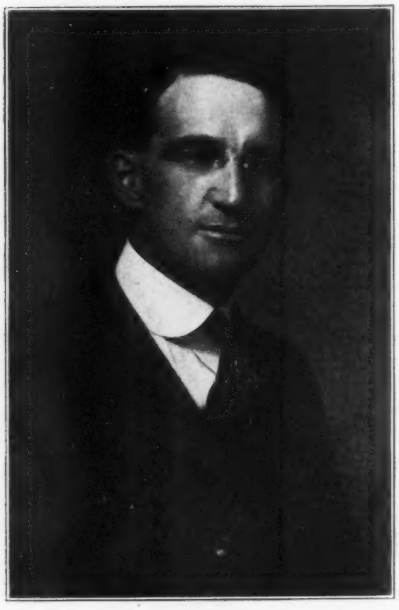
Pennsylvania Sand and Gravel Producers Organize

The Pennsylvania Sand and Gravel Producers' Association Has Been Founded, Officers Elected and Constitution and By-Laws Adopted

THE RESULT of much hard and diligent work on the part of a number of sand and gravel producers in the state of Pennsylvania was culminated May 7 and 8 in the Chamber of Commerce building at Pittsburgh by the formation of the Pennsylvania Sand and Gravel Producers' Association. Although one of our foremost states in industrial operations, Pennsylvania has been a little slow in the organization of a sand and gravel producers' association.

A number of the producers have long shown that they realized the necessity of an association by being members of the national association. Now that the organization has been completed, the activities outlined indicates that in the future it will make itself felt with force.

It is estimated that there are about 45 sand and gravel producers in the state. The association was formed with 20 of these as members and it is anticipated that very soon the other 25 will be members. One of the first slogans of the association will be to increase its membership so that it will not only have sufficient financial strength to be of real service, but so that it will truly be a representative organ of the sand and gravel producers of the State of Pennsylvania.



Alexander W. Dann, vice-president

Financing the Association

In order to start the association with a substantial amount in the treasury, the present initiation fee was made $100. In the future it will be reduced to $25 per member and one mill per ton on all commercial gravel and sand produced and sold within the state of Pennsylvania and one-fourth mill per ton for all railroad ballast produced and sold within the state, which shall be payable at the end of each quarter and shall be computed upon the tonnage so produced and sold during said quarter.

J. R. McGraw, president

Purpose of the Organization

The purpose of the organization is to advance the uses of sand and gravel in all lines of construction, ballast, etc., and to protect and represent the rights of sand and gravel producers against unfair legislation, in railroad problems and all matters of general concern.

The next year's program includes the combating of freight rate advances, better car service, the development of uses of sand and gravel in the manufacture of new articles and placing sand and gravel upon an equal competing basis with other materials used for mineral aggregates.

Officers and Executive Committee

The constitution and by-laws were drawn up and adopted. Officers for the ensuing year were elected as follows: J. R. McGraw of the Ohio River Sand Co., president; Alexander Dann of the Keystone Sand & Supply Co., vice president; Harry Davison of the J. K. Davison & Bro. Sand Co., secretary and treasurer, and C. C. Whiteside of the Rock Point Sand Co., executive secretary. All officers except the executive secretary are elected to serve for one year without compensation. The executive secretary is appointed by the president and his salary fixed by the executive committee.

The executive committee consists of the elective officers and Joseph Hoeveler of the Iron City Sand Co. and William Smith of the Davison & Bro. Sand Co.

Committees on membership, specifications of sand and gravel and program and entertainment were appointed.

Official communications may either be addressed to the president, J. R. McGraw, Ohio River Sand Co., 415 House Building, Pittsburgh, Pa., or the executive secretary, C. C. Whiteside, Rock Point Sand Co., Wabash Building, Pittsburgh.

C. C. Whiteside, executive secretary

Missouri Valley Sand and Gravel Producers Hold Live Meeting

Problems Frankly Discussed and Experiences Exchanged—Business Showing Signs of Slowing Up

A MEETING SECOND TO NONE in its importance to the Missouri Valley Association of Sand and Gravel Producers, was the one held at the Hotel Muehlebach, Kansas City, Mo., May 12. Over two-thirds of the members were in attendance, and all districts were well represented. Two new members were taken in at the meeting, and a campaign was started to enlist the few remaining producers in Kansas who have not yet joined the Association. The Articles of Association were amended so as to admit producers in the State of Oklahoma who have signified a preference to join the organization. The membership now represents over ninety per cent of the production of the entire district, and it is hoped to make this one hundred per cent within the next thirty to sixty days.

The meeting opened with a review of the Association's past and present activities and an outline of its plans for the future. The finances were shown to be in a healthy condition as reported by T. G. Wear, treasurer.

Freight Rates Discussed

Proposed freight rate increases came in for a large part of the discussion. John Prince, President of the Stewart Sand Co., and chairman of the meeting, speaking on this subject, stated that in his opinion an increase of about 24 per cent might be expected in the Western States and about 28 per cent in the Eastern States. Mr. Prince told the members of the efforts of the National Association in combating the proposed increases, and its work with the National Crushed Stone Association, through a joint committee, to have mineral aggregates eliminated from any general percentage increases that may be made. He urged upon the producers the importance of furnishing the freight rate data requested for the National Association so as to provide it with sufficient facts and statistics upon which to base its contentions. One strong point brought out by Mr. Prince was that the present rates on our commodity were producing a higher revenue per ton mile than the average of all other commodities handled in the United States, as evidenced by statistics already worked out by the National Association.

J. A. Paddock, President of the Manhattan Sand Co., speaking on the same subject, stated that any further increases would be a serious handicap to the industry in this section of the country, and that the present high rates were the cause of the numerous side-of-the-road plants that are springing up over night. It was his opinion that the original cost of these plants was high, and that they were not a paying proposition, yet they were able to operate locally, due to excessive freight rates. Mr. Paddock then offered a resolution, which was given unanimous approval, that this meeting request the National Association to use every influence at its command to prevent further increases on sand and gravel.

A different view of this situation was presented in a letter to the Association by J. A. Daly of the Osage Sand & Contracting Co. Mr. Daly stated that it is not the high freight rate that is hurting our business so much as a lack of railway equipment, and that if an increase is made a proportion of the increased revenue should be used for the construction of new equipment and power.

Car Shortage Problems

C. E. Todd, President of the Kaw River Sand Company and a member of the National Advisory Council, told the members of the recent meeting of the Council at Chicago on April 29 and 30, what its objects were, and gave an outline of its proposed plans in aid of the work of the National Association. Mr. Todd also referred to the car situation and to the work being done by the National Association along this line. He stated that its business manager, E. Guy Sutton, has exceptional opportunities to take up this matter for the individual producers with the Car Service Committee in Washington; that Mr. Sutton had already been successful in getting satisfactory distribution of cars, and that complaints backed by information showing cars ordered, cars supplied, capacity of plants, etc., would receive prompt attention on the part of the business manager. He cited instances where the National Association had been of direct benefit to the producers by taking up their individual claims.

Mr. Todd also told of the efforts of other industries with the railroads in getting new equipment constructed for their particular use and offered a resolution urging the National Association to impress upon the Association of Railway Executives the need of additional open-top cars for the sand industry. Speaking further of the action of the Advisory Council, he stated that there was considerable sentiment at the last meeting to have the offices of the National Association moved to Washington so as to be at the seat of activity. After some discussion of this subject, a resolution was offered by C. E. Brown that it was the opinion of this meeting that the best interests of the National Association would be served by having its offices removed to Washington, D. C., at the earliest possible time, and a copy of this resolution was forwarded to E. Guy Sutton, National Secretary.

Orders Slowing Up

The general situation as summed up from the reports of the different districts seemed to be that orders are getting behind production, and that at the same time the car supply is entirely inadequate.

N. C. Dunn, President of the Arkansas City Sand Co., speaking for the operators of the Lower Arkansas River district, stated that business was slowing up and was not up to production; also that the car situation was very bad.

Paul Orlopp, President of the Topeka Sand Co., representing the Upper Kaw River operators, also stated that orders were slowing up, but that the car situation in his district was somewhat improved.

Harry E. Moore, Secretary of the Missouri River Sand & Gravel Co., referred to conditions in the Lower Missouri district as being normal, with a slight slowing up of orders. He stated that, due to his location at a division point, he was not handicapped with a car shortage.

Conditions in Jefferson City (also a Lower Missouri point) seem to be the best over the territory, according to George F. Walleau of the Jefferson City Sand & Gravel Co. He stated that he was getting good car service and that orders were keeping ahead of production.

That the Lower Kaw River operators had suffered most was the opinion of C. E. Todd, who referred to the situation in this district as being the most unsatisfactory it had ever been, due in

part to the switchmen's strike. He stated that orders in his district were also slowing up.

C. E. Brown, of the Hutchinson Supply Co., referred to conditions in Western Kansas as being fairly good, with the exception of the car supply, which had handicapped his operation. He said he had some cancellations, due to the tightness of the money market.

There was considerable interest manifested in the subject of uniform cost keeping as explained by J. D. Crockett of the firm of Crockett, Couchman & Crawford, professional accountants. Mr. Crockett spoke of the necessity of accurate costs, of the value of uniform systems, and outlined in detail the system being installed in the plants of the members of our Association.

Maj. Charles W. Bartlett, Chairman of the Commitee on Uniform Methods of Cost Keeping, gave a few strong illustrations of the benefits his company has already received as a result of adopting the Association's system and commended it to all members present. Major Bartlett produced a series of photographs taken of junked equipment at his plant, caused by damage from ice, sinkings, etc., which, aside from being interesting, provided indisputable evidence of the large loss sustained annually, and which few operators figure as an item of cost. Evidence was cited to show that a 20 per cent charge yearly would barely cover the loss so sustained.

Membership matters came in for their share of the discussion, and several committees were appointed to visit producers who have not yet come into the Association.

Entertainment, Too

It was a great meeting and well worth the time of every one present, and those who were not in attendance passed up an opportunity to benefit from the experiences and the exchange of ideas of those present; the topics discussed, and the good fellowship manifested.

The members enjoyed a luncheon provided by the Association, and several stayed over and attended the theatre in the evening.

Coal Priority Rumor Disclaimed

A NEWS DISPATCH published today stated that managers of roads centering in Columbus, Ohio, would seek conference with the Interstate Commerce Commission this week to urge priority orders in favor of coal. Chicago officials of the American Association disclaim knowledge of a move of this sort and express the opinion that it would be very impractical under present conditions.—The Illinois Sand and Gravel Producers' Association Weekly Bulletin.

Railroads Need More Switchmen

WHAT RAILROADS need more than cars are additional men and additional locomotives, particularly the additional men. It is known absolutely that railroad officials and newspapers are temporizing and covering up the true labor situation of the railroads. The switchmen's strike is not over, but rather a large number of these men have permanently quit their positions and have gone into other lines of activity where more money can be made.

Until the agency set up by the government to adjust these wage scales decides on a higher rate of pay for switchmen we are going to continue, at least this year, having transportation difficulties.—Wisconsin Mineral Aggregates Association General Letter.

Establish So-Called Obsolete Rates and Charges

THE INTERSTATE COMMERCE COMMISSION, in its reduced rate order No. 202, dated Washington, April 28, 1920, has authorized carriers to re-establish so-called obsolete rates and charges, which were withdrawn by carriers during the period of federal control, in instances where traffic is offered or notice is received that it is about to be offered in sufficient quantities to warrant re-establishment of the former rates.—The Illinois Sand and Gravel Producers' Association Weekly Bulletin.

General Business Conditions

IT IS GENERALLY recognized now that there is a great lack of transportation and that there must be an immediate improvement in the operation of the railroads if we are to avoid widespread economic loss. The impending presidential election undoubtedly has some general influence on business, but when we consider the happenings of the past two weeks we must look for other causes.

All reports indicate a considerable decrease in farm production for 1920; the trade digests show a decline in the volume of business in many lines, this being particularly noticeable in the East; basic industries are at a standstill and many factories have been closed or are on part time basis because of inability to obtain raw materials and to move manufactured goods.

It is a common prediction that the late summer or early fall will bring a severe test of our financial system. However true that may be, it is certain that business and industry throughout the country is marking time, and it behooves every man to consider carefully the relation of his business to the general situation.—The Illinois Sand and Gravel Producers' Association Weekly Bulletin.

New Director of the Bureau of Mines Nominated

WASHINGTON.—The nomination of Dr. Frederick G. Cottrell for director of the Bureau of Mines, Department of the Interior, has been sent to the Senate by President Wilson, to take the place of Dr. Van H. Manning, resigned. Dr. Cottrell was the assistant director of the Bureau under Dr. Manning.

Dr. Cottrell has been widely educated in both the United States and Europe and has devoted his entire life to study and research. His chief contribution to science has been research relating to the electrical precipitation of particles suspended in smelter gases.

Dr. Cottrell is a member of the American Chemical Society, Mining and Metallurgical Society of America, the American Electrochemical Society and the American Institute of Mining and Metallurgical Engineers. He was awarded the Perkin medal by the New York Section of the Society of Chemical Industry in 1919 in recognition of his work on electrical precipitation.

Freight Rate Reduction Rumor

A REPORT has come from Washington that some thought has been given to a reduction in freight rates on all commodities effecting construction. With the shortage of homes in all communities, all mineral aggregate producers should talk and father this thought, procuring newspaper publicity of the idea wherever possible.

It can readily be seen that a 15 cent increase in freight rate on a pair of shoes would amount to very little to each individual purchaser, while a 15-cent per ton freight rate on sand, gravel or stone would be a calamity although the increase on the shoes would bring several dollars per ton increase in the freight. There are a large number of other commodities in the same class.—Wisconsin Mineral Aggregates Association General Letter.

Representative Committees to Confer on Transportation

RECOGNIZING the need for intelligent co-operation of shippers and carriers in the present emergency, Chairman Clark of the Interstate Commerce Commission has requested the American Railroad Association and the National Industrial Traffic League to appoint representative committees to confer on transportation conditions and to make recommendations as to what action should or should not be taken by the commission in the exercise of its powers under the interstate commerce act.—The Illinois Sand and Gravel Producers' Association Weekly Bulletin.

Possibilities of Peat as a Fuel for Lime Kilns

In Spite of Many Failures to Utilize Peat Commercially, It Has Many Advantages as a Lime-Burning Fuel and Valuable By-Products Are Possible

By Henry H. Hinshaw
Mining Engineer, Hibbing, Minn.

PEAT IS COAL in its first stages of formation. The essential difference between the two is in the greater content of water and oxygen in the peat. Between dry peat and coal the chemical difference is chiefly in oxygen. Coal and peat are mixtures of fixed carbon and volatile combustibles. Average coal has two parts of fixed carbon to one part volatile. Peat has the reversed ratio—one part fixed carbon to two parts volatile. Driving off the volatile contents leaves coke from coal and charcoal from peat. The term "coke" is used in an improper manner in the publications of the U. S. Bureau of Mines and authors, and refers to peat charcoal. The heating value of fuel is expressed in either calories or British thermal units (B. t. u.).

Various modifying factors come in so that these units can not exactly be predicated from the chemical analyses, so tests are made by burning in a calorimeter. This gives, roughly, about one-third greater heating value for a ton of coal than for a ton of peat, but for direct firing this is not fair to peat, as the loss in efficiency in fuel is the necessity of heating the inert gasses in the air necessary to supply oxygen for combustion. For peat burns with about seven-tenths of the amount of air necessary for the combustion of coal.

The expense of coal is in mining and transportation; of peat, in drying and transportation. Drying peat can be easily matched with mining coal, but transportation is the main disadvantage, as dry peat is twice as bulky as coal, so coal handling costs are multiplied by two.

Methods of Using Peat

There are available six different methods of utilizing peat:

1. As cut peat or turf such as is used in northern Europe. This has no commercial application.

2. Machine peat. As direct-fired fuel has two-thirds value of coal. Costs twice coal costs for handling and transportation. A variation in the shape of peat briquettes is subject to the same objections. These may be considered as coal substitutes to be discarded when coal can be obtained at a 50 per cent higher cost than peat.

3. Machined peat—ground fine or atomized—however, is an excellent fuel and will be used as soon as obtainable. It has some advantages over powdered coal.

4. Machined peat as producer gas fuel. Peat has been used so long in this manner that it is known to be a much better fuel than coal. It does not coke, so allows the free and even passage of air and gases in the producer. The ash is powdery and never clinkers, so the ashes are easily removed. The ash has value as a source of potash and the tar is not as troublesome as that from soft coal. The gas can be used in kilns or under boilers or piped to centers of population for general heating and cooking purposes.

5. As fuel in Mond by-product recovery producer plants. The value of peat sulphate of ammonia is about equal to its fuel value and its saving will more than pay for all the expense of producing the fuel.

6. Distillation, either in by-product saving ovens or kilns. By this method the carbon is usable as charcoal, gas for heat and power and a line of chemical products made which is only limited by the means supplied to utilize them. What these would be is not now known. Ammonia is one of the most important. The products of coal distillation are known, so are those of wood. Peat products would come in with a parallel series between the two with unlimited possibilities in the line of dyes and pharmaceuticals.

Peat has been monkeyed with for fifty years. Little one-horse operations have come and gone and new ones coming. We have never been really in need of peat until now, on account of our abundant coal supplies. We need pay no more attention to the hundreds of peat failures than we would to coal mine operations attempted with a tin pail and toy shovel. Some of them have been useful in showing what not to do.

Occurrence of Peat

Now as to peat as it occurs:

It is a mat of vegetable matter, having been preserved from decay by submersion in water. It is usually from 5 to 15 ft. in thickness. Usually it is drainable, as the peat is built up, the drainage held back by its accumulation. It holds 80 to 90 per cent of water. To dry it, its structure must be broken down, machined. The density of the product depends largely on the extent to which it is machined.

The effect of machining is not generally understood and elaborate far-fetched theories have been propounded to explain it. It is easily demonstrated by anyone who can get a handful of peat and a domestic meat grinder. Raw, it feels harsh and considerable water, down to about 70 per cent moisture, can be squeezed out in the hand. Put through the sausage machine with the perforated plate, the first time there is little change except it feels smoother. Put through successively half a dozen times, it becomes a new substance. It is smooth and plastic and comes through the plate in long, tenaceous strings like spaghetti. The raw peat dries like a sponge, open and porous without shrinking, contains 30 to 35 per cent moisture when "dry," burns with a strong pungent smoke. Properly machined, the peat shrinks together and dries in a hard mass down to 10 or 15 per cent moisture and burns almost without smoke or smell.

Machined Peat

Many machines have been designed for working peat. In Germany and Sweden, they have been made with regard to little operations with cheap labor conditions. Their importation, trial and failure in this country has retarded the development of peat's use. American inventors, hundreds of them, have invented machines mostly to force peat to do that which it will not do, and have tried to feed it raw into one end and get the finished product at the other.

Making machine peat is as simple as making brick, and the same machinery is as good for one as the other, but the treatment is different. Peat will drain down to 65 or 70 per cent water content. This is about the right consistency to put through a disintegrator or pug mill. The brick-working pug and auger mill will machine and mold the pulped peat

into blocks suitable to handle and place on racks or in sheds to dry.

A successful plant should be of not less capacity than 50 to 100 tons of finished product per day. With such a plant hand labor can be reduced to the minimum. Its design should be made by an engineer who understands peat. He is a rare animal at present, but some time some state university will wake up and train a few of them.

Machined peat should be considered not as fuel, although it is very good direct fired, it is very much better ground to powder and fired with the proper amount of air for its perfect combustion.

As Gas-Producer Fuel—By Products

In the gas producer the whole fuel, both fixed and volatile, is gasified. The gas is excellent for gas engine use or burning. A ton of good dry peat will give about 100,000 cu. ft. of producer gas with 140 B.t.u. per foot. This gas would be excellent for lime kilns.

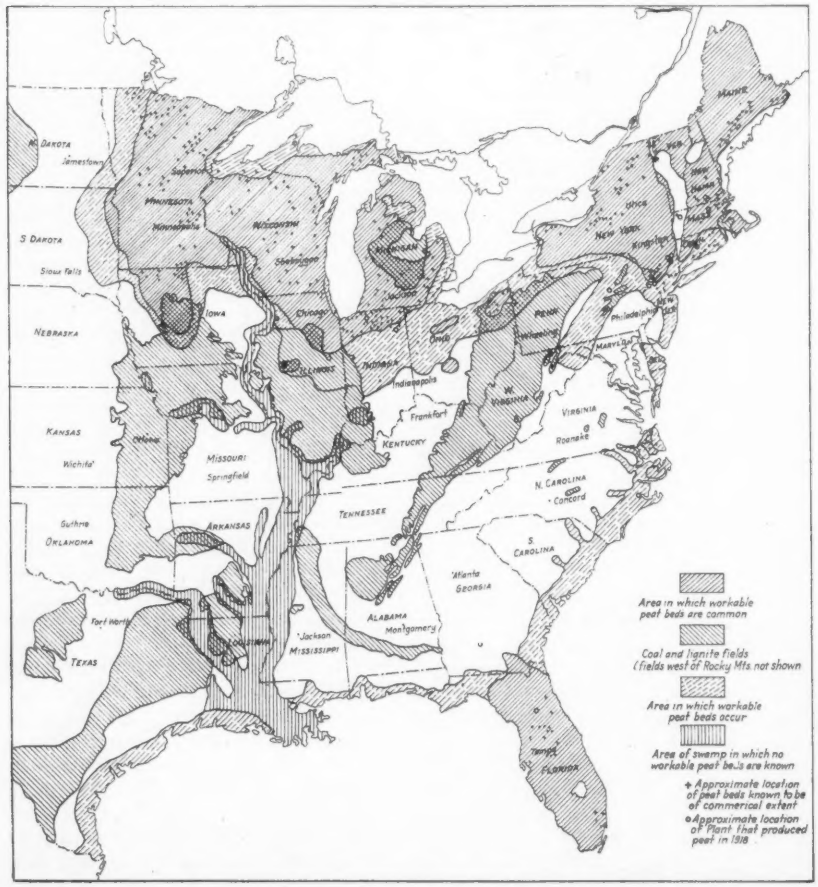
A more economical use of peat is by by-product saving producers. Nitrogen, in the form of sulphate of ammonia can never be produced in excess of its demand as fertilizer. Its recovery pays a large percentage of the profit on coke making and has made possible the distillation of Scotch oil shales, in spite of cheap oil well supplies. In a recent prospectus of an American oil shale company, its value is put at 10 cents per pound. Many peat beds contain more than 2 per cent of nitrogen. This means a recoverable 150 pounds of sulphate of ammonia to the ton. At five cents per pound, it would equal $7.50 per ton of peat.

There is one step further to consider in the use of peat. It can be handled in by-product ovens similar to those used with coal. The fixed carbon will be charcoal. Means have recently been discovered for making of this friable product, a charcoal as dense and strong as wood charcoal and very desirable for many metallurgical processes. The high percentage of hydrocarbons and gas, proportionately about twice the amount of that in coal, makes its utilization in this manner very desirable.

Great Extent of Peat Beds

Few people have any conception of the extent of peat deposits. An acre of peat contains, on a dry basis, 200 tons to the acre for each foot of depth. New York, Michigan, Wisconsin and Minnesota contain hundreds of square miles of peat. The tonnage estimated for Minnesota alone is 6,800,000,000. Removing the peat generally leaves a much more fertile land than the peat itself and the peat surface may be used to raise crops without detracting from the fuel value which can be made available at some future time.

It is possible to dry peat on a small scale but not generally desirable. The better method is to combine enough interests to operate a moderately large central plant and pipe gas or transmit electricity to users.


Area in which workable peat beds are common
Coal and lignite fields (fields west of Rocky Mts. not shown
Area in which workable peat beds occur
Area of swamp in which no workable peat beds are known
+ Approximate location of peat beds known to be of commerical extent
○ Approximate location of Plant that produced peat in 1918

Map of the eastern half of the United States showing peat deposits

Lime Facilitates Chuting of Concrete

LEONARD C. WASON, president of the Aberthaw Construction Co. of Boston, Mass., in an article appearing in the March issue of "Concrete," discusses the difficulties encountered in chuting concrete on large structures or where local conditions require the chutes to be of any considerable length.

He points out the fact that in ordinary practice it is necessary to construct chutes with a drop of 3 or even 4 ft. in every 10, and that even with this slope it is often necessary to add excessive amounts of water to the concrete in order to lubricate the mixture; this excess water **being a decided detriment to the ultimate strength of the concrete.** He further points out that under such conditions it is often advisable to provide auxiliary hoppers at the lower end of each section of the chute in order to re-mix the concrete and so overcome the segregation which otherwise takes place because of the presence of this water.

In a recent press bulletin the National Lime Association reminds all engineers and contractors of the fact that various references covering the above points are made in the bulletins issued by its construction department. These references clearly bring out the fact that the judicious use of hydrated lime will go far toward eliminating these objectionable features, reducing the expense involved in the construction of extremely high towers and remixing hoppers, besides promoting workability in the forms.

A notable instance is the construction of the filtration plant at St. Louis, Mo., with the addition of hydrated lime to the concrete. Chutes 400 ft. long were used having a drop of **only 2 ft. in every 10.** No trouble was experienced in handling this concrete and little working was required in order to produce a satisfactory watertight job.

Many other instances of a similar nature are set forth in the various publications of the construction department of the National Lime Association, and much valuable data is given regarding the benefits already secured by those who have used lime in their concrete construction.

Practical Chemistry for Lime and Cement Manufacturers

IV—Valency; Acids, Bases and Salts and How They Are Formed

By Richard K. Meade, M. S.

Consulting Chemical and Industrial Engineer, 11-13 E. Fayette St., Baltimore, Maryland

WE FIND ON EXAMINATION that atoms differ as to the number of atoms of other elements with which they can combine. Thus we find that only one atom of hydrogen will combine with one atom of chlorine (forming hydrochloric acid, HCl), but that as many as two will combine with oxygen (forming water, H_2O), as many as three with nitrogen (forming ammonia, NH_3), and as many as four with carbon (forming marsh gas, CH_4). The number of hydrogen atoms with which each element combines is known as its "valence." Thus the valence of chlorine is I, oxygen II, nitrogen III and carbon IV. As a practical illustration of valence, let us consider the atoms as spheres with hooks to which chemical connections can be attached. Now hydrogen has, say, one hook, oxygen two, nitrogen three, carbon four, etc., somewhat as shown in Fig. 2.

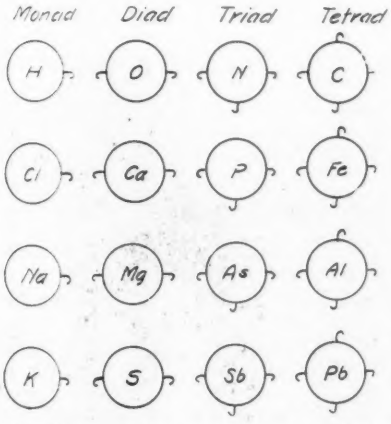


Fig. 2, illustrating valence of chemical elements

Now it is evident we can fasten two atoms of hydrogen to one of oxygen or two or oxygen to one of carbon or two of hydrogen and one of oxygen to carbon, etc. Fig. 3 illustrates numerous examples of actual combinations.

It must not be supposed, however, that valence is anything like a "hook" on the atom, or, as I have said, that chemical affinity is like a link or a rope or a bond. What force actually holds the atoms together and why this force is only sufficient to hold a certain number of atoms together we do not know. The examples I have given in Figs. 1, 2 and 3 are merely illustrations to make the subject clear.

Acids, Bases and Salts

When an atom of any compound can be easily liberated or replaced by an atom of another compound, we speak of it as being loosely combined. All *acids* contain the element hydrogen. In an acid, the affinity between the hydrogen and the other elements which compose it is, however, relatively slight, hence the hydrogen of an acid may be said to be loosely combined. In many acids the hydrogen may be replaced by some metal by simply pouring the acid on the metal, the hydrogen being given off as a gas. An acid is defined as a compound containing loosely combined hydrogen which can be replaced by a metal or a base. It must not be supposed, however, that the test of this is whether the acid will act on a metal and give off hydrogen. In many cases this substitution or replacement must be made by round-about ways.

Acids have a sour taste and cause effervescence (evolution of gas with bubbling) when added to a carbonate. In a Sedlitz powder, with which most people are unpleasantly acquainted, the effervescence is caused by mixing an acid (tartaric) contained in the white paper with sodium bicarbonate in the blue paper. Similarly if almost any mineral acid is poured upon powdered high calcium limestone effervescence will occur.

Acids turn blue litmus paper red and ordinarily this is the test for an acid.

Oxygen combines with all of the metals forming what are known as *bases*. Examples of bases are lime which is the oxide of calcium; magnesia, the oxide of magnesia and soda, the oxide of sodium.

Water is composed of two atoms of hydrogen and one of oxygen, one of these atoms can be replaced by a metal. When this occurs the product is an alkali, or more strictly a hydrate or hydroxide. Thus when sodium is brought in contact with water sodium hydrate or hydroxide is formed.

$$Na + H_2O =$$

Sodium and water produce

$$NaOH + H$$

sodium hydrate and hydrogen.

Many hydrates are not formed directly by the action of the water on the metal, but by acting on the oxide of the metal with water. A familiar instance of this is the production of calcium hydrate, or hydrated lime, by the addition of water to calcium oxide (lime).

$$CaO + H_2O = Ca(OH)_2$$

Lime and water produce calcium hydrate.

In the symbol of all hydrates or hydroxides you will find the expression "OH." This is the remains of the water after the hydrogen has been replaced. Solutions of alkalies turn red litmus paper blue.

When an acid and a base are mixed in proper proportions the two neutralize each other and form a new substance which has

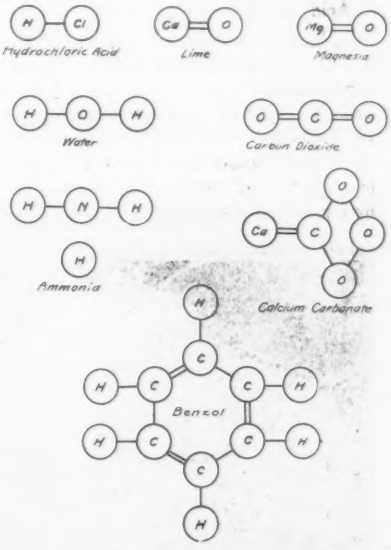


Fig. 3, illustrating chemical combinations

neither the properties of an acid or a base. This new compound we call a *salt*. A chemical salt should not be confused with common table salt or sodium chloride. Table salt is *a* salt, but a chemical salt is not necessarily sodium chloride. When the chemist speaks of *a* "salt" he means the compound formed by the union of an acid and a base.

Acid		Base	Salt		Water
H_2SO_4	+	CaO	= $CaSO_4$	+	H_2O
2HCl	+	CaO	= $CaCl_2$	+	H_2O
H_2SO_4	+	MgO	= $MgSO_4$	+	H_2O
H_2SO_4	+	Na_2O	= Na_2SO_4	+	H_2O
2HCl	+	Na_2O	= 2NaCl	+	H_2O
2HCl	+	Zn	= Zn_2Cl	+	H_2O
H_2SO_4	+	Fe	= $FeSO_4$	+	H_2O

You will notice that in each case water

H_2O also is formed. When an acid acts on a base therefore the products of the reaction are a salt and water.

It must not be supposed that the only way of producing a salt is by neutralizing an acid with a base. There are many ways of doing this, one of the most commonly employed is by what is known as "double substitution." In this case two salts (usually dissolved in water) are mixed and the acid of the one unites with the base of the other and *visa versa.*

$CaCl_2$ + Na_2CO_3 = $2NaCl_2$ +
Calcium and Sodium produce Sodium and
Chloride Carbonate Chloride

$CaCO_3$
Calcium
Carbonate

Strong acids often will replace weaker ones and if the weak acid is a gas it will be given off. An example of this is the action of sulphuric acid on calcium carbonate, the stronger acid, sulphuric, replacing the weaker one, carbonic.

H_2SO_4 + $CaCO_3$ = $CaSO_4$
Sulphuric and Calcium produce Calcium
Acid Carbonate Sulphate

+ CO_2 + H_2O
and Carbon and Water.
Dioxide

The carbon dioxide is a gas and passes off from the solution in bubbles, causing effervescence.

Having outlined in a general way the basic facts and theories of the science we may proceed to study some of the elements and compounds ordinarily met with in the lime and cement industries.

(To be continued)

Hydrating Plant of the Vermarco Lime Company

THE ACCOMPANYING views were inadvertently omitted from the article in the May 8 issue of ROCK PRODUCTS, describing the plant of the Vermarco Lime Co. at West Rutland, Vt.

Interest in this hydrating plant lies chiefly in the arrangement. It is located under the same roof as the kiln room. The lime as discharged from the kiln goes through a rotary cooler, placed end to end with the kiln, into the boot of an enclosed elevator. This elevator discharges to overhead steel bins, as shown in View 2 below, which in turn feed a Kritzer continuous hydrator.

As described in the article referred to, the limestone is pulverized before it is fed to the kiln and the lime as it leaves the cooler is in proper physical condition for the hydrator.

From the hydrator the lime hydrate goes through a Raymond mill and air separator and the finished product is conveyed by air to the hydrate bins over the Bates four-valve bagging machine.

The views shown give an idea of the arrangement of this equipment and show the light and headroom available in the packing and shipping room. Beyond the packing machine is 60 or 70 ft. of clear floor space for storage of sacked and barreled lime.

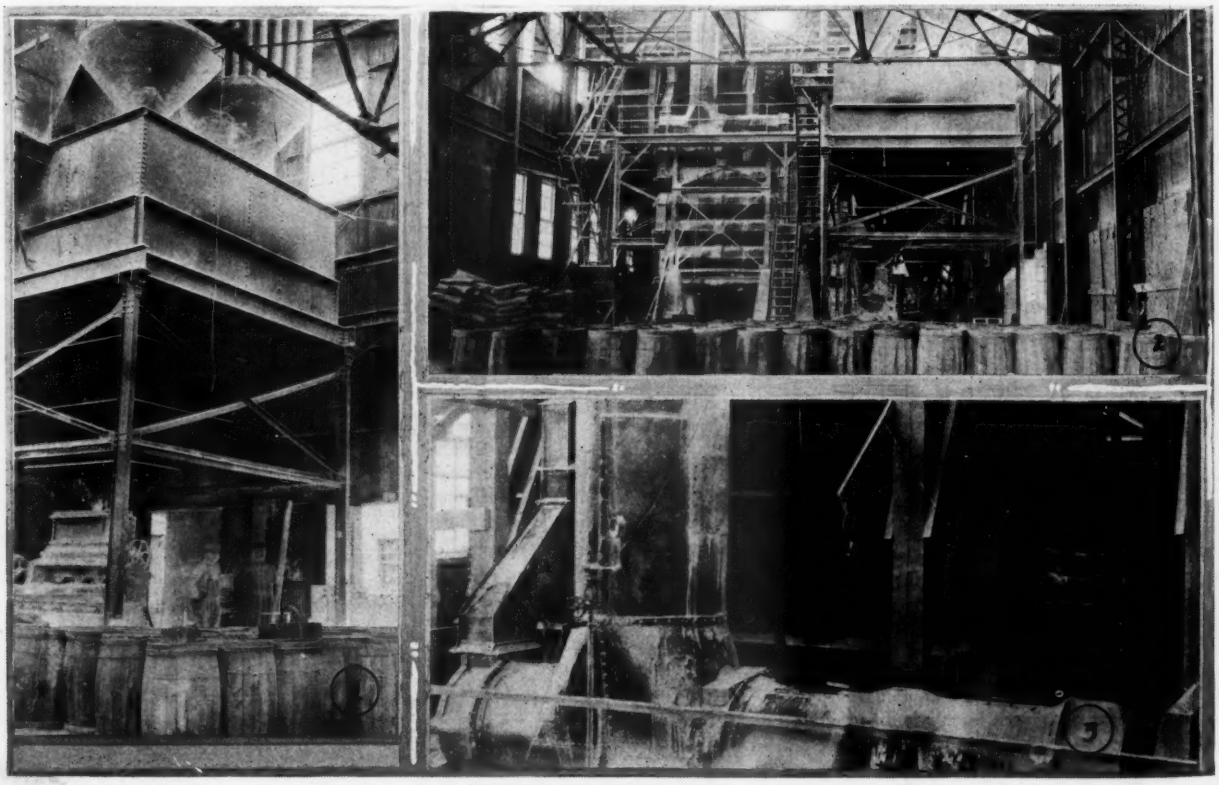
Government Takes Over Freight Traffic Control

ACTING UNDER ITS emergency powers granted by the recent Esch-Cummins railway law, the Interstate Commerce Commission on May 20 assumed control of freight traffic on all the principal lines of the country.

It is said that immediate steps will be taken to return to western roads box cars belonging to them that have been long held in the east, and to return to eastern roads open-top cars held in the west.

If this is done the situation of western cement and lime manufacturers will be relieved. In any event the situation could hardly be worse than it is at present. The exchange undoubtedly is due to the need of moving crops rather than building materials, but the presence of the cars in this territory will be a big help.

The open-top car shortage, however, may be made even more acute by the diversion of all available cars to the coal mines on account of the alleged coal shortage and the desire of manufacturing plants to stock up against a similar emergency later.



Hydrating end of the lime plant of the Vermarco Lime Co., subsidiary of the Vermont Marble Co., at West Rutland, Vt. (1) Packing machine and bins for hydrate; (2) hydrator and lime-storage bins; hydrator feed and stack for steam and gases

Motor Truck Shipments Save Chicago Building Tie-Up

Data Regarding Portland Cement Shipments from Factory to Job

By David D. Bush
Assistant to the Vice-President, Consumers Co., Chicago, Ill.

MOVING TRAINLOADS OF CEMENT without cars—that was the problem we faced late last winter. As on one or two former occasions when rail shipments were completely tied up, we called upon our large fleet of heavy motor trucks, and they brought in the cement day after day on schedule. Operating over a nearly continuous ribbon of hard-surfaced highways connecting the cement plant at Buffington, Ind., with the paved streets of Chicago, these trucks carried direct to the job as much as 2500 barrels, or the equivalent of twelve good carloads in a day. And the cement was badly needed, for otherwise much of Chicago's building activity would have ceased.

From the growing scarcity of cars, it became evident early in February that we could no longer meet the demand for cement through shipments over the railroads. The extensive building program of the city, hard hit last season by the strike and lockout in the building trades, and later by the lack of aggregates, apparently was about to meet with another serious obstacle in a shortage of cement. But realizing that it was entirely a matter of transportation, we investigated the possibilities of truck hauling, knowing that a good route, paved much of the way with concrete, led from the cement plant to Chicago's street system. By the middle of February conditions became so acute that we began cement hauling with 30 of our fleet of 7½-ton Mack trucks.

Throughout the early spring when unimproved roads are simply impassable for heavy hauling, our big trucks carried 200 sacks of cement on each trip to the city. Several of the trucks were equipped with trailers, and on these the load was doubled to 400 sacks, or 100 barrels. Only a few years ago this made a minimum carload, but of course, much heavier loading has been the rule of late.

Nearly 6000 Bbls. in One Day

Sunday, May 2, with a fleet of 45 trucks, we hauled 115 loads from Buffington, a total of 5820 barrels of cement. We did this without the necessity of our having any calls for service in the garage. This appears to be a very fine record, not only from a hauling but also service standpoint, as the trucks were under

Moving 6,000 bbls. of cement a day from a single mill to the city of Chicago

heavy strain the entire day, loading to maximum capacity.

As the building season advanced, more and more work opened up until our trucks were supplying approximately one hundred jobs. As rail shipments were entirely out of the question during the terminal tie-up in April, and practically so for the remainder of the time, the progress of these jobs and the employment of hundreds of workmen depended upon the continuity of our truck deliveries.

In all, 30 or 40 other dealers and a few contractors were also hauling from Buffington on a smaller scale. Cement was delivered in all parts of Chicago and many of the surrounding towns, with hauls ranging up to 37 miles. The approximate distance to the loop in Chicago is 25 miles. When one considers the great volume of building work dependent upon this truck hauling, and the probability of similar situations in other industries, the construction of paved, connecting highways takes on renewed importance.

The Universal Portland Cement Co., which operates the Buffington plant, has given out as typical these figures on the volume of cement shipments on a day in February: By rail, approximately 5600 barrels were loaded in 28 freight cars, while 9000 barrels went out in 192 motor trucks.

Keeping Trucks in A-1 Condition

Naturally every care is taken to keep our trucks in efficient working condition under this severe usage. No new methods have been found necessary, however, as in our other heavy hauling operations we have worked out a plan of operation and careful maintenance that is rigidly adhered to with our entire fleet, now numbering more than 100. Our 7½-ton trucks are governed to a speed of 10 miles an hour, as we have learned that operating at a faster rate does not pay. But at this speed, we find that each truck can carry up to 10 tons on pavements without injury to the machine.

Every night after the trucks are in the garage two gangs of men go over them thoroughly. For every 10 trucks we have one washer and one greaser, and the work these men do is carried out in no perfunctory manner. Washing the trucks, using kerosene where it is needed, keeps grit from working into the delicate running parts of the machinery. Our oilers have instructions to see that grease is fairly oozing out of every working part, and we want it applied to nuts and bolts as well. Each night the sides of the springs are painted with waste oil, and as a consequence we have no springs with the leaves rusted together, and our spring repair bills are practically nothing. This will furnish an idea of the care given our trucks so that they can be depended upon for service day after day. We find that it pays.

Truck Traffic Control

Responsibility for delivering cement, and indeed all other materials as well, is placed upon our Transportation Department. Each morning the superintendent of garages reports to the central office what disposition has been made of the equipment. By means of colored tacks this information is graphically shown on the schedule or dispatch board that hangs in the office of the transportation manager.

All of the trucks used in cement hauling check in at our yard 204, located 7650 So. Chicago Ave., where they receive orders from the main office dispatcher for deliveries and again communicate with the dispatcher at the point of delivery for further orders. In this way we are in continual touch with our drivers as they communicate with our dispatching office, from Buffington, our yard 204 and from point of delivery, and we are thus able to eliminate practically all of the unproductive mileage which of course proves costly and unprofitable.

Residential Building Permits Increase Greatly

THE OUTSTANDING FEATURE of the F. W. Dodge Company's April building statistics is the fact that residential building has, after lagging behind for some months, resumed the place of prime importance over all other classes of construction. Figures on awards of contracts in the territory north of the Ohio and east of the Missouri Rivers during April give to residential building 31 per cent of the total, whereas during the first quarter of the year it represented but 19 per cent of the total.

The total amount of contracts awarded during April, 1920, in the Dodge Company's territory was $334,007,000; this shows a slight increase over the March figure, which was $327,897,000, and a very considerable increase over the figure for April, 1919, which was $188,852,000. The total for the first four months of 1920 amounts to $1,114,415,000, as compared with $464,407,000 for the first four months of 1919.

Analysis of the April figures shows $103,743,000, or 31 per cent for residential buildings; $65,498,000, or 20 per cent, for public works and utilities; $62,181,000, or 19 per cent, for industrial buildings; and $57,115,000, or 15 per cent, for business buildings.

During April contemplated work was reported amounting to $445,053,000, bringing the total for contemplated work reported for the first four months of this year up to $2,144,637,000. Contemplated work reported from January 1 to May 1, included $482,344,000 for residential buildings; $432,523,000 for industrial buildings; $423,317,000 for public works and utilities; $301,693,000 for business buildings.

Building contracts awarded in April in the New England States amounted to $28,971,000, which is one-third less than the figure for March, although it is double the figure for April of last year.

In New York State and northern New Jersey, building contracts in April amounted to $87,741,000 an increase of 31 per cent over the figure for the month of March, and over three times the figure for April, 1919.

April building contracts in eastern Pennsylvania, southern New Jersey, Maryland, Delaware, the District of Columbia and Virginia, amounted to $50,-644,000, which is practically equal to the March figure, although it is 81 per cent greater than the figure for April, 1919.

Building contracts let during April in western Pennsylvania, West Viriginia and Ohio amounted to $60,811,000, a decrease of 10 per cent from the preceding month, but an increase of 82 per cent over the figure for April of last year.

Building contracts let in the central west (comprising Illinois, Indiana, Iowa, Wisconsin, Michigan, and portions of Missouri and eastern Kansas) in April amounted to $94,523,000, an increase of 5 per cent over the figure for the preceding month, and an increase of 18 per cent over April, 1919. As building costs have increased considerably more than 18 per cent during the past year, this indicates a decrease in actual volume of construction as between April, 1919, and April, 1920.

April building contracts in Minnesota and North and South Dakota amounted to $11,316,400, which was practically the same as the figure for the preceding month, although it was more than double the figure for April, 1919.

Wisconsin Cement Shortage Still Serious

NO IMPROVEMENT is being shown in the Wisconsin cement shortage except that at a few lake ports cement is now being received by boat. O. C. Hubbard, executive secretary of the Wisconsin Mineral Aggregates Association, has been advised by one of the cement representatives that they still have December business on their books unshipped, with several hundred carload orders placed in January and increasing numbers for succeeding months yet to move.

As the season grows older, of course, this will materially affect the mineral aggregates producers' business. Mr. Hubbard states that the time is now ripe for all association members to start talking and boosting for macadam and gravel roads, which, if desired, can be resurfaced with other material in years to come, when conditions are more normal.

Efficiency of Rotary Kilns

Losses from Coarse Grinding of Fuel—Losses in Heat Waste and Proposed Process of Heat Conservation

By W. E. Snyder, Chemist
Allentown, Pa.
Expert on the Manufacture of Portland and White Cements

AGAIN THE WHEEL of agitation is brought to its former momentum on the subject of the efficiency of rotary cement kilns. This very important and interesting subject somehow pops up periodically. Some 15 years ago this subject was brought to the attention of the manufacturers by various scientific investigators, but after a lengthy magazine debate pro and con, it appears to have been forced into a deep and silent slumber, so now this subject apparently has been annoyed and brought back to a degree of activity, which no doubt is caused by the effects of the recent world war.

The articles along the lines of this subject which appeared in recent publications by Robert W. Lesley, Rapier R. Coghlan and S. B. Newberry, are in general most interesting and should be sufficient to convince the manufacturers of the vital necessity and future possibilities for further improvements in the present rotary kiln process. It is the writer's private opinion that if someone would volunteer to try out these splendid suggestions, it would soon be learned what extraordinary results can be accomplished in a practical way, which, however, is so often misconstrued when only the theoretical side of the subject is discussed, and thus causing a detention of progress.

Preparation of Coal-Saving in Fine Grinding

First of all, let us take into consideration the preparation of the coal as a fuel, which is the initial procedure and where the starting point of the investigation and changes should take place. There has been a lavish waste of coal in rotary kilns in the past, due largely to coarse grinding. In order to obtain the full value of the coal as a rotary kiln fuel, we must disregard or eliminate all 100-mesh material and be guided by the 200-mesh and even the 300-mesh sieves. In the experiments carried out by the writer some 14 years ago, trying out coal as a fuel for burning white cement and overcome discoloration by the contamination of fuel ashes with the cement clinker, it was learned that for every 1 per cent of 100-mesh, one pound of fuel was wasted per barrel of clinker burned. This not only applies to white cement, but the gray or standard portland cement as well, this coal or fuel was ground in a tube mill and afterward separated by air, thus eliminating all 100-mesh material, which gave by sieve test 93 per cent passing a 200-mesh sieve and 83 per cent passing a 300-mesh sieve. This operation, however, was too expensive, so it was decided to use oil as a fuel instead, as it was considerably cheaper.

This extreme fine grinding in those days was entirely impracticable, but with the constant improvement achieved in grinding machines, it is at this time a practical proposition. By this extreme fine grinding from five to ten pounds of coal per barrel can be saved to start out with. To mention any fixed figure in dollars and cents the saving of this small item will amount to, perhaps would be misleading due to the uncertainty of coal prices. It is a very simple problem and anyone familiar with the prevailing prices of coal can quickly ascertain the saving thus in store.

Combustion in Rotary Kilns

Let us now go one step further and take into consideration the index or working condition of the kiln, its construction, together with the revision of the process necessary to accomplish improved efficiency. There has been so much agitation on the subject of excess air entering the rotary cement kiln over that theoretically required for complete combustion that the writer is inclined to believe that something should be said along these lines in order to make it a little more comprehensive and further that perhaps there is much less space for economy on this subject as has heretofore been expected. In a publication some time past, an attempt was made to show the large percentage of air passing through the kiln in excess to that theoretically required for combustion, an analysis of the kiln gases was given, in which the free oxygen amounted to very near 12 per cent, while the carbon monoxide (CO) was given at one-half of 1 per cent.

The high percentage of free oxygen, however, indicates a very large percentage of air in excess, providing the sample of gas was taken direct from the mouth or intake of the kiln. If this sample were taken from the stack, it is quite evident that the gases had been considerably diluted by the air which creeps in through the flue doors and the opening between the flue and the revolving kiln. It appears impossible to accurately determine the index or working condition of a rotary kiln by taking the gas samples from the stack and afterward approximating the amount of dilution which is apt to yield results of more or less uncertainty. The writer has not yet found two kilns that yield a gas when drawn from the stack of exactly the same dilution, and therefore considers the proper place to sample the gas for determining the index of a kiln, to be direct from the mouth or intake, where there is no possible chance for contamination.

No Excess Oxygen in Actual Kiln Gases

In order to show the dilution which takes place in the flue between the kiln and the stack, the writer has sampled and analyzed the gas from a rotary cement kiln, using powdered coal as a fuel which yielded the following:

SAMPLE No. 1

CO_2	12.40%
O	10.00%
CO	0.00%
N, etc., by difference	77.60%

The high percentage of free oxygen in analysis No. 1 certainly confirms the published results referred to very closely, but this, however, does not convince anyone that such was the index of the kiln, after knowing that the gas was drawn from the stack where it becomes diluted with air which creeps in through the openings in the flue.

After all openings in the flue were closed as tight as possible, with the exception of that space necessary between the kiln and the flue, the second sample was drawn from the stack which yielded the following:

SAMPLE No. 2

CO_2	14.20%
O	9.40%
CO	0.05%
N, etc., by difference	76.35%

The decrease in the percentage of free oxygen in analysis No. 2 brought about strong evidence to the fact that the index of the kiln was considerably better than that indicated by the previous analysis.

In order to show the exact index of the kiln, a sample was drawn direct from the mouth or intake which yielded a gas of the following composition:

ANALYSIS No. 3

CO_2	29.30%
O	0.70%
CO	0.40%
N, etc., by difference	69.60%

This should be sufficient proof to show that there is a very slim chance for improvement on the excess air subject, if

the burner in charge will at all times apply the proper precautions. At this very point it becomes vital that the operating superintendent and chemist co-operate in order to arrive at the maximum output of the kilns with the minimum consumption of fuel.

It is an established fact that the kiln is the heart of a cement plant, and if this department is neglected, no other department will make up for it. How many mill superintendents and chemists in the cement field today are capable to take complete charge of a kiln building in a practical way? In any event the best results will never be obtained until the operating superintendent and chemist in charge of every cement plant will make a special effort to learn the practical end of rotary kilns and their local conditions, of which only a thorough knowledge can be obtained through the practical experience of kiln burning. This may, however, appear to be rather a laborious task, but this is a vital necessity and should be put in universal practice for the benefit of the investor and improvement in efficiency in general.

Rotary Kiln Control

A rotary kiln is very simple in its construction, in fact, nothing but a cylindrical shell of heavy sheet iron of various diameters and length, lined with firebrick and placed on a slightly inclined position for the purpose of conveying the raw mix or composition from the mouth or intake, to the discharge end of the kiln as it revolves. At this point the combustible or fuel, such as gas, oil or powdered coal, is blown in through an opening in the hood continuously, to keep up the temperature necessary, to convert the raw material to complete incineration.

The temperature required as per pyrometric measurement ranges from 2600 to 2900 degrees F., at the point where the clinker is formed, but at the combustion zone the temperature is still higher. This process of burning, as can be seen, depends entirely on the radiation of the deflagrated zone, together with the reverberatory action of the upper half of the kiln shell. The different temperatures required to form a clinker of perfect vitrification depend upon the preparation of the cement mixture.

The capacity of kiln production is very often hampered, unconsciously, when the capacity of the raw grinding department falls below that of the actual kiln capacity, in which case it is a very common occurrence to force the raw grinding beyond its normal capacity, thus feeding the kiln with coarse material which causes a decreased kiln production and an increased fuel consumption. This effect is also experienced when a kiln is fed with a so-called overlimed mixture. Oftentimes through some neglect or other both these undesirable things take place at one and the same time. In this event the kiln is looked upon to make good the negligence of prior steps for which the kiln is not responsible. The manufacturer is at this point facing two unpleasant burdens, only one of which will he be able to overcome, while the other will be a costly sacrifice.

It is, however, poor practice to overburden kilns in this manner, but is very often the case, unconsciously, however, due to the lack of practical experience in kiln burning. If we take into consideration the immense cavity in a rotary kiln that must continuously be kept at a degree of incineration and the loss of heat by radiation, kiln gases and the heat necessary to preheat air, whether excess or normal, with a combustible that is in practical use today, we can plainly see that the kiln has burdens of its own and should not be expected to carry that of any other department. We must admit that the rotary kiln process, as it is operated today, is indeed crude and wasteful. The question may now arise as to what are we going to do?

We have these kilns installed and we must therefore continue to operate them until someone can or will tell us what improvements can be applied or what other type kiln to install of normal efficiency. The long type kiln introduced by Thos. A. Edison is showing up to be a sound step towards improved efficiency, but this process is still too wasteful and leaves much room for improvement before it becomes vital to take up the question of a new type kiln. Mr. Edison's introduction did not change the principal, it is still a rotary kiln, but he managed to get greater efficiency of the combustible by adding an additional length through which the heat must travel, thus increasing the time of absorption by the cement mixture. We cannot stop at this stage of the game after knowing the large percentage of heat that is lost and the possibilities in store for further elimination.

Let us take the figures as given by Rapier R. Coghlan in his report on the "Rationale of the Burning of Portland Cement Clinker" in the March issue of "Concrete," which gives us a very complete and comprehensive explanation of where the heat of the fuel supplied to the kiln in burning clinker averts to. Let us take these figures as a base which show that we have a loss:

Extracted by gases at 1300 deg. F., of ..... 511,517 B.t.u.
Loss by conduction and radiation of.. 169,371 B.t.u.
Preheating air to 2600 deg. F., of..... 132,804 B.t.u.

Or a total consumption of..... 813,692 B.t.u.

from the fuel supplied or an equivalent of 58.12 pounds of coal at a value of 14,000 B.t.u. per pound.

If we take a coal generally used showing a heating value of 12,000 B.t.u. per pound, the loss will show an equivalent of 67.8 pounds, not considering the heat carried off by the hot clinker. At this rate it can readily be seen that it is a vital necessity for someone, as S. B. Newberry stated in a discussion in the February issue of the "Concrete": "To do some dreaming and think out things."

Proposed Process of Conserving Heat in Kilns

This can be applied on the subject of these lavish heat losses. This is a subject that the writer has devoted much of his time to in the past few years, having discovered a process by which as per calculations and experiments carried out in his laboratory, would make it possible to save approximately 50 per cent of the present losses, and with careful construction and operation approximately 60 per cent could be saved. This process will not require new kilns, nor will the expenditure to install this process be anywhere near the cost of new kilns.

The writer's process starts where Edison left off by building an additional shell around the present kiln approximately three-fourths or even more than that distance down the kiln toward its discharge end, where the outer shell enters a dust chamber in the same manner as the kiln now enters the present dust chamber. The stack is removed from the rear end and is placed at the front dust chamber where the outer shell enters. The operation is the same, with the exception that instead of the kiln gases passing out into and up the stack, the gas is reverted and carried in opposite direction between the present and outer shell, or in other words in the same direction as the travel of the feed, thus insulating the kiln with hot gases.

This also serves as a dust arrester, due to the loss of velocity of the traveling gases. This additional shell serves as a flue which automatically cleans itself by the rotating action of the kiln. The lower portion of the kiln is also encircled by a shell, its intake somewhat funnel shaped, starting a short distance from the new dust chamber and continues down along the kiln to its end, where it enters the hood so constructed as to create a suction or draft taking in air at or near the new dust chamber, preheating it by means of the radiating action over and around the point of the combustion zone, thus administering an extreme hot volume of air in place of partly heated or cold air as heretofore.

This may be better known as the "double-shell process," serving as a fuel-saving device and dust arrester combined. It is needless to mention at this time the saving possibilities and other advantages yet in store, for anyone familiar with the present rotary kiln process can readily grasp its features.

Bureau of Standards Tests on Cement and Gypsum

Concrete Made of Fine Ground Cement Gave Greater Strength Than Concrete With Normal Ground Cement

THE TECHNICAL NEWS BULLETIN No. 37, issued May 6, 1920, by the Bureau of Standards, Department of Commerce, contains a number of interesting experiments carried on by the Bureau, among which are the following:

Comparative Tests of Normally and Finely Ground Cement

The data obtained from tests on a normally ground and a finely ground cement of the same brand have been computed and a report issued. These two cements were tested in 1 : 1½ : 2, 1 : 2 : 4, and 1 : 3 : 6 concretes of two consistencies, as well as in a neat mix, and in a 1 : 3 standard sand mortar. The following results and conclusions were obtained:

(1) The strengths of concrete made of the fine cement were regularly and consistently greater than those made with the normal cement so far as the tests have been completed.

(2) The percentage increases in the strength of the fine cement concretes over the normal cement concretes for different periods were:

	2 days Per cent	7 days Per cent	28 days Per cent	3 m. Per cent	6m. Per cent
Minimum	90	50	30	21	14
Average	121	66	56	41	42

It should be noted that the difference in fineness between the two cements was 12 per cent, and to obtain the per cent increase in strength for each per cent increase in fineness the figures in the above table showing the increase should be divided by 12. The normally ground cement had 86 per cent passing the 200-mesh sieve as compared with 98 per cent for the finely ground material.

A Means for Causing Gypsum to Adhere to Concrete

During the past month the research on the above subject and also on a means for causing cement plaster to adhere to gypsum has been practically completed. The findings may be divided into three parts:

1. There seems to be no detrimental reaction between the two materials; the tensile strength of the mixture of gypsum and cement is very nearly equal to their combined tensile strengths dependent upon the proportions of the two ingredients used.

2. The suction of the surface to which the plaster is applied is an extremely important factor; for example, if gypsum plaster is applied to a dry concrete surface the suction of the concrete will take so much water out of the gypsum that it will prevent its proper hardening.

3. The expansion of neat cement when wet is of an entirely different order from the expansion of neat gypsum and a bond between the two materials can be permanently maintained only when enough sand is added to both materials to reduce the same for both. The above-mentioned research work has been supported by the Gypsum Industries Association, and a report covering it has recently been made to them.—Commerce Reports.

To Develop Valuable Stone Deposit

WHAT geologists and experienced quarrymen pronounce to be the most valuable building stone ever found in the United States has been discovered 90 mi. south of Memphis in North Mississippi, along Big Bear Creek, according to J. H. Curtis. It is said to be the finest silica stone in America and the only other specimen of its kind is found near Edinburgh, Scotland, where most public buildings have been erected of it.

In order to market the stone C. C. and Thomas J. Wellford of Memphis, Tenn., and W. F. Dunbar of Atlanta, Ga., have secured an option on 1,100 acres of land through which the vein of rock has been traced. They are now organizing a $1,000,000 company to market the stone.

Practically all of the stone lies in a deep gorge, through which flows Big Bear Creek. There is little overburden to any of it, and engineers of the Illinois Central Railroad, who recently made a scientific examination of it, said there is enough stone to fill 100 railroad cars a day for 500 years.

Dr. L. C. Glenn, geologist of Vanderbilt University, Nashville, who went to the locality and made a report of his findings, said the vein averaged 25 and 30 ft. deep and that its bedding is usually remarkably uniform and parallel, so that when split along the bedding planes the blocks have almost perfectly even surfaces.

Air Hardens the Stone

When the stone is exposed to air it readily hardens, according to Dr. Glenn. It will resist weather indefinitely without crumbling or disintegrating, as is proven by the fresh surface of blocks built into a chimney 50 or more years ago, and still better proven by the sharp edges and corners and original fracture surfaces preserved on loose blocks that have lain exposed on the slopes beneath the cliffs for untold ages.

The natural color of the stone is white and free from the influence of surface percolating waters. It is still white, as was demonstrated by Mr. Wellford, who has samples of the stone taken several feet under the ground.

Experts say the stone can be marketed in Memphis 50 per cent cheaper than any other class of white building stone, and considerably cheaper than cement or brick. The Illinois Central Railroad has a track extending through the property.

Dr. Glenn also went into detail concerning the possible water power that can be developed at Big Bear Creek. He advised Mr. Wellford that by building a dam across the creek enough power can be obtained to operate the machinery at the quarry and it will also furnish power for generating electricity.

According to the present plans the most modern machinery used for such work will be installed at the quarry when it is opened. There will be houses built for employes and offices for the company. The principal office will be in Memphis.

Mr. Wellford said that plans for organizing the company were proceeding nicely and that most of the stock will be taken by Memphis capitalists.

Large Lime Machinery Manufacturer Expands

THE SCHAFFER ENGINEERING & EQUIPMENT CO., to provide for the expansion of its business and obtain ample plant facilities, has sold a large block of its capital stock to the Fawcus Machine Co. The Schaffer company does consulting engineering, and manufactures machinery, including poidometers, hydrators, coal injectors and screens. The rapid growth of its business necessitated better manufacturing facilities and assistance in handling the business.

The Fawcus Machine Co., manufacturers of gears and special types of machinery, with plants at Pittsburgh and Ford City will build all machinery required. The officials of the Fawcus Machine Co. have been taken into the Schaffer company.

This combination should prove of essential benefit to both companies and all users of their equipment and machinery.

The new officers and directors of the Schaffer Engineering and Equipment Co. are A. F. Cooke, president and general manager; J. C. Schaffer, vice-president; E. A. Kebler, vice-president; A. A. Alles, Jr., treasurer, and Walter Crow, secretary.

Give Your Support in Presenting the Freight Rate Case!

Most Momentous Matter Ever Faced by the Mineral Aggregate Industry

WITHIN THE NEXT FEW WEEKS the Interstate Commerce Commission will probably decide what increase in freight rates is necessary to meet the needs of the railways and incidentally what share of that increase the various commodities shall bear.

Either by accident or design the railways have so staged their play for increased rates that the request comes at a time when all shippers are nearly desperate, and if newspaper dispatches are to be relied upon, the condition of the country itself as regards vital supplies of food and fuel is nearly equally desperate.

Probably there will be an attempt made to rush through a blanket increase. There is a good deal of justification for this from both the railway and the uninformed public point of view. It is unquestionably the path of least resistance.

What effect a 25 or 50 per cent advance in rates will have upon the mineral aggregate industry no man can predict with any degree of certainty, but it is not a thing to be contemplated without some misgivings. The mineral aggregate industry differs from all others in that the material is the most easily procured and most cheaply prepared of any commercial product moved by the railways in any considerable amount.

The chief reason for concentrating production in large central plants, such as have grown up in the last few years, is the small economy of production in large amounts, as against the somewhat greater costs of operation of small dispersed plants. The measure of this economy is limited absolutely by the freight rates from the central plant to its markets.

When freight charges to move a commodity reach a figure where they amount to more than the value of the commodity itself, it does not require much demonstration to prove that any small economies in the cost of production of the material amount to absolutely nothing in favor of its use.

The railways and the public will not jeopardize a great industry with millions of invested capital if the real facts can be brought home to them. The railways will not annihilate a very considerable revenue-producing industry if they can be made to see that will be the result. The Interstate Commerce Commission will not permit an injustice to this industry, if it can be made to see that the injustice exists.

There probably is not one single producer of mineral aggregates in the length and breadth of the land who does not sincerely believe that a blanket increase of 25 to 50 per cent on top of the increases of 50 to 100 per cent suffered during the war would be rank injustice compared with increases on other commodities.

Probably there are a great many who sincerely believe that any further increase would ruin their business, and give an impetus to side-of-the-road plants that would be fatal to progress already made in slow but sure steps to better aggregates and construction.

Who is going to drive these things home to the railway authorities and the public and its representatives? Certainly not you individually nor any number of you individually. You wouldn't be listened to. Your chambers of commerce, traffic associations and the like have too many other interests to give much time to yours.

You will get scant help from the other building material interests. Very likely you will even have their opposition unless they, too, are included in your petition; and that would be fatal. The case of mineral aggregate producers must stand on its own merits and be presented by its own representatives.

In the National Associations you have those representatives. Unfortunately their membership is not so large nor their revenues so great as the scope and importance of their task demands. They are putting up the biggest fight for the industry that has ever been made in its history. They are fighting for justice for you; and you and every producer will benefit alike.

It means the compilation and presentation of proof that injustice has been done you. It means the expenditure of money to present this proof. Someone has got to put up that money to pay for all this. Have you done your share? Think it over. Even in a year when payments are so hard to make, and during a time when your contributions are asked for a variety of other purposes, can there be a more important demand upon your purse than this, or a more urgent one?

John Rice, president of the National Crushed Stone Association; A. P. Sandles, its secretary; V. O. Johnston, president of the National Association of Sand and Gravel Producers, and E. Guy Sutton, its secretary, are men of the highest integrity, honor and faithfulness. On this ROCK PRODUCTS speaks with certain knowledge. There should not be one moment's hesitation in intrusting them with the wise expenditure of every cent that can be raised to put into this fight. Whether you are a member of these associations or not, if you are shipper by rail, they are your only hope in seeing that justice and fair dealing is done your industry before the Interstate Commerce Commission at its hearings in Washington, commencing next week. It's up to you.

Phosphate Rock Production During 1919

The United States Geological Survey Reports Growth of the Phosphate Industry

THE QUANTITY of phosphate rock marketed in the United States in 1919 appears to have been less than in any year within the last decade except 1915. The production in South Carolina was nearly treble that of 1918, Tennessee greatly increased her output, and the Western States made a proportionately large gain, but a strike in the Florida pebble phosphate field, which lasted several months, so greatly reduced the output from that State that the record for the whole country shows a decided decrease in quantity. The value of the product in 1919, however, appears to have been greater than in any year since 1913.

According to estimates made by R. W. Stone, United States Geological Survey, Department of the Interior, from the incomplete returns available at the end of April, the quantity of phosphate rock sold in the United States in 1919 was about 1,941,700 long tons, valued at $10,335,900, as compared with 2,490,760 tons valued at $8,214,463 in 1918.

Florida

The production of phosphate rock in Florida in 1919 probably would have been approximately 2,500,000 tons, or nearly up to the output of 1913, had it not been for a strike in the pebble phosphate field, which lasted about seven months. The output of pebble phosphate was approximately 1,000,000 tons, or only about one-half that of 1918. It might well have been 2,000,000 tons. The production of hard rock, however, which was decreased by the cutting off of exports from 489,000 tons in 1913 to less than 18,000 tons in 1917, increased in 1918 to 62,000 tons and in 1919 to approximately 340,000 tons. Between 15,000 and 16,000 tons of soft phosphate and phosphatic marl, all of which is used for direct application to the soil, was sold at prices ranging from $4 to $15 a ton but averaging about $7. The total shipments from the States were about 1,355,000 tons, valued at $7,123,000. On account of the strike in the pebble phosphate field a greater quantity of hard rock was shipped to domestic factories than in previous years. The effect of the strike on the pebble phosphate industry is shown by the shipments through Tampa, Port Tampa, and Boca Grande, which fell from 63,000 tons in January, 1919, to 3,800 tons in June and rose to 94,000 tons in December.

South Carolina

Although reports of production in South Carolina in 1919 have been received from only one company the shipments reported indicate that the total output of the Charleston district was well over 100,000 tons and may have been nearly 120,000, approximately the quantity produced in 1914. The value of the rock sold in 1919 is estimated at more than $550,000. This is a fine "come back" for the South Carolina field, for it represents an increase of nearly 200 per cent in quantity over 1918.

Tennessee

The phosphate industry of Tennessee ranks next in magnitude to that of Florida. The quantity of unmined phosphate remaining in the ground is small, however, in comparison with that in the Western States, where production has only recently begun. It is estimated that Tennessee and Kentucky together produced and shipped 460,000 tons of phosphate rock in 1919, valued at about $2,580,600, a large increase in quantity and value over 1918. All but a few thousand tons of this rock was mined in Tennessee. Nearly every company that operated in both years increased its output. During much of the year there was difficulty in getting cars. With more favorable conditions of labor and transportation the State will probably make a larger output in 1920.

Kentucky

The United Phosphate & Chemical Co., which operates near Wallace, Ky., made an output of several thousand tons, the business showing little change from the previous year. This is the only company that is mining phosphate in Kentucky.

Western States

Idaho produced in 1919 at least 16,000 tons of high-grade phosphate rock, valued at $65,000, an increase of 33 per cent in quantity and about 55 per cent in value over the production of approximately 12,000 tons, valued at $42,000, in 1918. The operators in Idaho are the San Francisco Chemical Co., the Western Phosphate Mining & Manufacturing Co., and the Merriman Potash Products Co., operating in Bear Lake County. No reports for 1919 have been received from mines sometimes operated in Rich County, Utah, and Uinta County, Wyo.

Of the shipments made in 1919 from the western field about 10,000 tons was billed to California, 2,000 tons to Hawaii, and most of the rest to Illinois. The shipments made during the first three months of 1920 averaged more than 2,500 tons a month. Most of the rock was sent to California for treatment, some to Chicago, and one shipment of several hundred tons to Japan.

In February, 1920, it was reported that contracts have been made for large shipments of Idaho phosphate rock to Japan and that bunkers are being built on the dock at Portland, Ore., to provide for these shipments. It is reported also that the Anaconda Copper Mining Co. will operate a phosphate manufacturing plant in connection with its smelter at Anaconda. The phosphate rock for this plant will be mined at Melrose, south of Butte, and on Warm Spring Creek, north of Garrison, Mont.

Imports

Crude phosphate was formerly imported into the United States in quantities amounting to several thousand tons annually. At present, as shown by reports of the Bureau of Foreign and Domestic Commerce, the imports are practically negligible.

Exports

From 1913, when more than 1,300,000 tons of phosphate rock was exported, the quantity leaving the United States steadily decreased until 1918, when it was only 143,455 tons, a little more than one-tenth of the exports in 1913. In 1919, however, as more vessels became available for commerce, the exports increased to 378,731 tons. As Europe must import phosphate rock in large quantity to replenish her soils, the outlook for the export of phosphate rock is becoming increasingly bright.

In 1918-1919 most of the high-grade rock exported was sent to Sweden and Norway, and much of the land pebble to England, France, and Spain. Cuba and Canada also were notable consumers of phosphate rock mined in the United States. The records of the Bureau of Foreign and Domestic Commerce, shows that in 1919 Denmark was by far the largest importer of high-grade phosphate rock from this country and that Sweden and Germany stood in the second and third places. England, the Netherlands, and Denmark took more than half the exports of land pebble, England taking the largest quantity by a small margin.—U. S. Geological Survey Press Bulletin.

NEW MACHINERY AND EQUIPMENT

New Ore-Washing Device

A NEW DEVICE for concentrating Minnesota iron ores, which may find an application in the silica sand or sand and gravel industries, has been tested at Minnesota School of Mines Experiment Station by Edward W. Davis, whose report is published as Bulletin No. 6 of the University of Minnesota, School of Mines. The new machine is illustrated herewith and is known as the Dorr ore washer.

Flow of Material Through the Machine

The material to be washed enters through the feed spout and falls directly into the revolving screen where the coarse material is completely washed before being discharged over the rear end of the classifier. The material that passes through the openings in the screen enters the tank of the classifier, where the coarser and heavier particles settle to the bottom and are raked out and discharged at the upper end of the classifier. The finer and lighter particles are kept in suspension by the rakes and are discharged as tailing with the excess water admitted as a surface spray at the upper end of the tank.

The speed of the trommel or screen is so adjusted that the material within it is subjected to a cascading action similar to the action of the material in a ball mill. The lumps of sand or gravel are carried out of the water on the side of the trommel, from which position they fall or cascade back into the water. This action continues until the material finally reaches the lower end of the trommel where a discharge scoop, similar to the feed scoop of a ball mill, picks up the coarse washed material and discharges it, comparatively free from water, from the machine.

The Effect of a Small Slope

In order to carry a considerable charge of material in the trommel at all times, the slope is made very small. This has the effect of causing the particles to rub together and to wear off the soft clay or silt. The presence of large lumps in the trommel is quite desirable in order to increase this abrasive action, and no preliminary screening or sizing is found necessary.

By placing a coarse screen or grate across the trommel near the discharge end, the coarse material may be retained in the trommel, thereby greatly increasing the abrasion. This is particularly desirable when the material contains a large amount of paint rock or partially disintegrated silica. The abrasive effect may be further increased, if necessary, by the addition of steel balls.

Power Required Is Proportional to Speed and Load

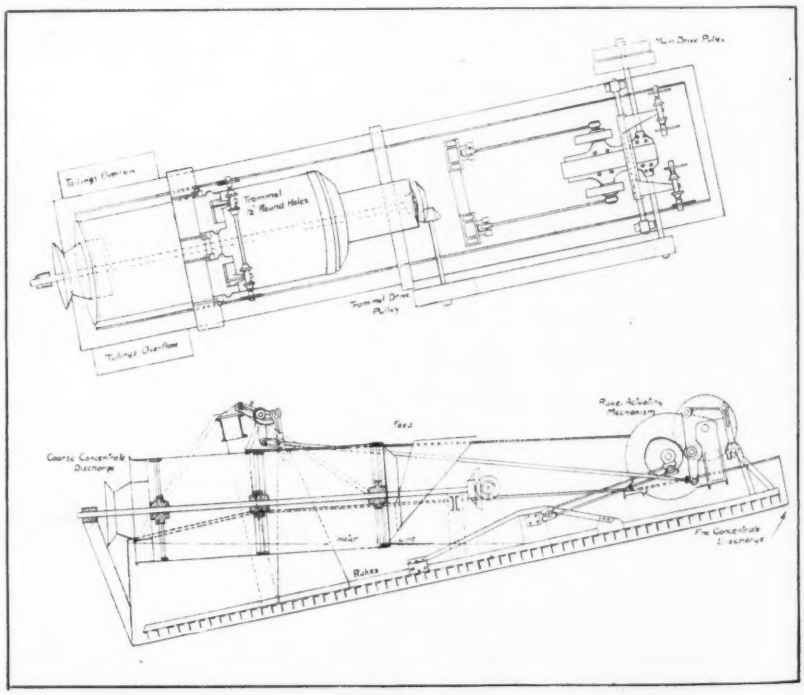
The power required to operate a trommel of any given dimension is proportional to the speed and the load of material that it carries. The trommel, therefore, may be considered as a modification of a ball mill and by slight alterations may be made to operate as much like a ball mill as is desired.

The Dorr classifier which is used as the tank is a well known standard machine and has been in successful use many years. It is simple, rugged, efficient, and requires a minimum amount of attention, repairs and power. The operation of the rakes may be described as similar to the actions of a man with a hoe, raking material out of a pool of water and up a slight incline. The hoe, or rake, as it is called, is made of two channel irons running the length of the machine. Across the underside of the two channel irons, angle irons are riveted. The angle irons are spaced 4 in. apart, thus providing a great number of these hoes in the length of the washer.

The Cycle of Operation

The cycle of operation consists in dropping the big rake into the material that has settled to the bottom of the classifier, moving the rake forward 6 in. together with its load of material, raising the rake out of the ore, moving it backward to the original position, and dropping it into the ore again. This cyclic motion is produced by cams and bell cranks, all located near the upper end of the machine and well above the water line. All of the parts are slow moving, and records show that maintenance costs on machines handling as much as 100 tons of material per hour are exceptionally small. This can be explained by the fact that a machine raking out 1 ton of ore per minute requires less than 5 horse power for operation.

The machine as built and tested in the laboratory of the Experiment Station is 8 ft. long and 2½ ft. wide. The trommel is 1½ ft. in diameter and 3 ft. long. This experimental plant is comparatively small, as the full-sized Dorr classifier is 27½ ft. long and 6 ft. wide. The trommel with which the full-sized machine will be equipped will be 4 ft. in diameter and 10 ft. long. It will be made of ⅜-in. steel plate punched with round holes ½ in. in diameter spaced 1 in.



Dorr ore washer, tested at Minnesota Experiment Station

Wahl Dehydrating Machine for Fine Sand

AN ENTIRELY NEW device for dewatering fine grades of sand, rock phosphate, etc., has been put on the market by H. R. Wahl & Co., Engineers, First National Bank Bldg., Chicago, Ill. The device is described as follows: "The machine consists mainly of a deep, narrow water tank, containing a primary settling chamber within its upper central portion, having a feed inlet trough at one side, as may be seen very plainly in the view.

"A supplemental elongated settling tank of V-shaped section joins the main tank at right angles to its side and receives the overflow from the primary settling chamber through a narrow slotted opening in the upper part of their partition wall. The opposite end of the supplemental tank is provided with an overflow weir, which maintains a water level in both tanks.

The Rotor

"Partly submerged within the main tank and supported on two pairs of rollers is a narrow-faced open-end cylinder or rotor, of U-shaped cross section, equipped with tires upon which it rotates, encircling the primary settling chamber. The rotor receives on the lower portion of its inner periphery the solids which have settled through the bottom outlet of the chamber.

"Following the interior periphery of the rotor a number of buckets are pivotally supported between its side plates, with sufficient clearance at both sides and end to allow the buckets to swing freely within proper limits, determined by adjustable stops at the bearings located on the outside of the rotor.

"It is to be observed that when in operation, both rotor and buckets revolve together about the settling chamber, and thereby elevate, dewater and discharge the solids from the machine without attrition.

Separate Compartments

"The solids are confined to the interior of the rotor by means of stationary semi-circular partition plates which extend from the side walls of the tank to a point directly over the side plates of the rotor, terminating in a tongue and groove spaced joint, so constructed as to admit water in a direction at right angles to the direction of the descending solids.

"The space in the main tank, surrounding the exterior of the rotor, is thus made a separate compartment, and contains only clear water to an equal level with that in the interior compartment, having communication through the spaced joint only, when water is supplied through some small pipes at the bottom of the tank.

"The rotor is driven by spur gearing from an intermediate shaft at one side, to which power is transmitted from the countershaft by another spur gear reduction. A belt drive from the countershaft also operates the screw conveyor located near the bottom of the supplemental settling tank, which conveys the finer solids settled therein back to the rotor to be dewatered.

"Above the main tank and directly over the primary settling chamber, a spout receives the solids discharged from the buckets, and delivers them to a convenient point to be conducted away. At each side of the spout are drip aprons which extend downward to the top of the tank and conduct the water which drains from the solid material back to the tank.

Operation

"The feed enters in a continuous stream through the inlet trough at the top of the settling chamber. The coarser solids immediately sink through the bottom outlet of the chamber to the periphery of the rotor.

"The solids are then carried along by the revolving of the rotor. When the slope of the surface becomes too steep to retain them, they slide gently into the buckets.

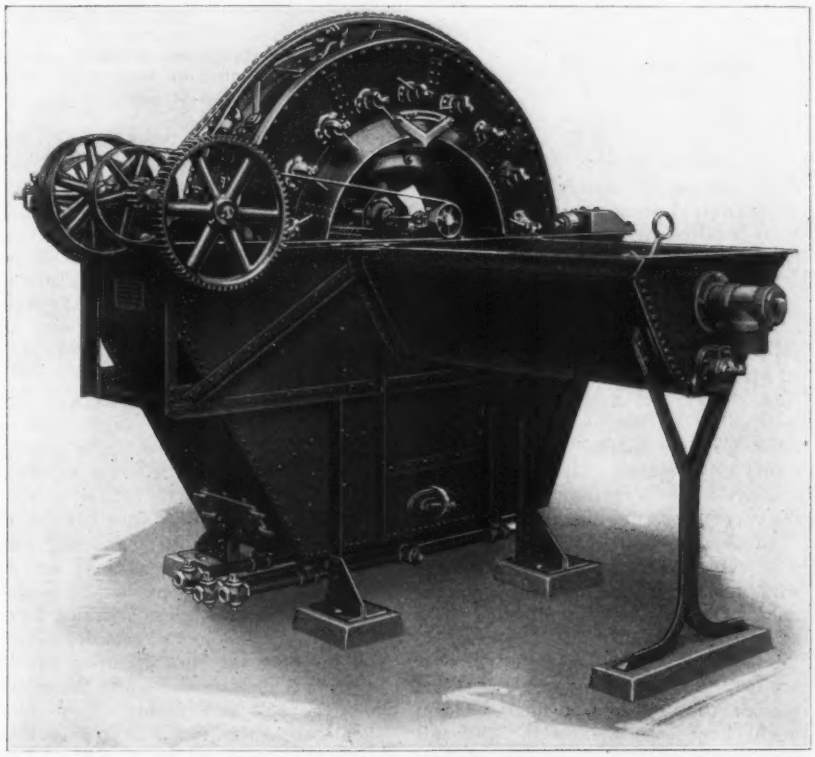
"When the buckets emerge from the water they also take up a quantity of water. As the bottom of the bucket gradually assumes a horizontal position while approaching the top of the rotor, the water is drained off over the inner edge, returning to the tank over the drip apron.

"At their uppermost position the buckets are automatically tripped and turned over, the outer edge of each bucket in turn striking the overturned edge of the preceding bucket, thereby completely discharging its contents into the discharge spout. With the revolving of the rotor the overturned buckets are again swung back to the position for loading.

"A distinctive feature of this machine is that water drained from each load of solids elevated, is returned to the tank without contaminating the load in the bucket following. This results in greater efficiency."

Capacity as High as 50 Tons of Solids Per Hour

This machine is made in various sizes up to a capacity of 50 tons of solids per hour. This largest size has a 14-ft. rotor, but requires only about 2 h.p. to operate, according to the manufacturer's claims. This is, of course, a very low horsepower consumption for so large a machine.



The Wahl dehydrating machine which is used for dewatering fine grades of sand, rock phosphate, etc.

Dangers of Gyratory Crushers

(Reprinted from the Accident Prevention Bulletin of the Portland Cement Association for March and April.)

A GYRATORY CRUSHER is a very dangerous machine. Any crusher operator, if he is honest with himself, must admit that fact. In spite of this, it is a common thing to see crusher men disregard many of the very simple and easily applicable safety measures which would make the operation safe. When working near a crusher men should wear safety belts attached to ropes, and it goes without saying that it is the company's duty to furnish this equipment and see that it is used. Often men do not use the safety appliances furnished them because the danger involved has not been put before them in the right light. Possibly they do not see the danger, because they have done the same work for years without mishap. Again their superiors may not have made any attempt to enforce the rules which they have once issued.

A recent report received by the Bureau of Accident Prevention and Insurance told of a man who, while working at a gyratory crusher as hookman, was taken severely ill with vertigo. Fortunately the report records merely a case of sickness, but how little would have been required to make this one of the many unexplainable fatal accidents.

It is commonly known that a person threatened by an attack of vertigo feels as if surrounding objects were whirled around or as if he himself has been whirled around. There is a strong tendency to fall. If the man in the case referred to had lost his balance and had fallen into the crusher a fatal accident would have resulted. Did the man wear a safety belt? Very likely not, at least the report does not mention it.

Another recent report tells of a man who, while punching rock into a crusher with a bar had the bar caught in the crusher and was hit on the head by it as it swung around. The only result in this case was that his right ear was bruised. Had the blow been severe enough to stun him a fatal accident might have been the result. Did this man wear a safety belt? The report does not say.

In neither of these accidents was any time lost, but if these two companies had followed the method of some of not reporting "trivial things," nothing would have been known of the danger to which two men were exposed. The object of reporting is as much to expose unsuspected dangers as to compile statistics on time lost. When we know the dangers we can guard against them by taking necessary precautions before accidents occur.

Example of dangerous working conditions which soener or later result in a serious accident

Some very severe accidents have occurred at crushers. The superintendent at one plant has no trouble in getting the men to use the belts. It is an absolute rule at this plant that if the crusher men wish to keep their jobs belts must be used. Do not satisfy yourself with the idea that your "conditions are so different." A gyratory crusher, no matter where it is, must be given attention when it refuses to take hold of rock fed into it and the only way this attention should be given is the safe way—with the use of a safety belt and railing. Your men should know this, and it is up to you to bring it to their attention. Do it now before another case of vertigo or tripping on a stone or being hit by a bar sends a man into the jaws of almost certain death.

[While the above remarks specifically refer to "gyratory" crushers, pretty much the same applies to jaw and roll crushers. The accompanying view shows a common condition at many crushing plants. If you would avoid the chance of a serious accident don't let workmen stand on the stone at the mouth of a crusher in operation—any kind of a crusher.—Editor.]

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Possibilities of Colorado Oil Shale Industry

Natural Oil Running Short, But Oil Shale of Colorado Will Provide for 800 Years

By Victor C. Alderson
(President Colorado School of Mines)

IN COLORADO there are 2,500 sq. mi. of oil shale bearing land. In many places the shale is known to be hundreds of feet thick. To be conservative, assume only 30 feet of accessible and workable shale. On this basis there would be 58,080,000,000 tons of shale, or approximately 60,000,000,000 barrels of oil stored up in the shale available for extraction and industrial use. To extract this amount would require the continuous operation of 100 plants, treating 2,000 tons a day for 800 years. Oil shale, then, as a source of supply for oil is virtually inexhaustible.

Dawn of a New Industry

There are 250,000 producing oil wells in the United States. Their production averages only 4½ barrels a day, even though the Burkburnett pool has produced 7,000,000 barrels and the Ranger pool 12,000,000. The low average is caused by thousands of wells in the older fields that produce less than a quarter of a barrel a day. The United States geographical survey is authority for the statement that "the consumption of petroleum is increasing far more rapidly than domestic production" and that "our underground reserves are 40 per cent exhausted and that we probably are near the peak of domestic production." Add to this the recent advance in price of mid-continental crude oil from $2.25 to $2.50 a barrel at the wells and we have a condition for serious thought.

The Quarterly of the Colorado School of Mines for October, 1919, gives in detail the cost of mining and retorting oil shale and estimates the total cost to be $1.85 a barrel, on the assumed basis of large tonnage and efficient management. The day is not far distant, then, when large and economical plants will be erected to produce shale oil at a cost that will make it a lively competitor of well oil.

Produces Gas and Oil

When shale is subjected to destructive distillation—heated in a closed vessel—not only is oil manufactured, but gas as well. Careful experiments show that in a plant of 400 tons daily capacity, enough gas is produced, in addition to the oil, to be equivalent to the heat value of thirty tons of coal daily. That is, after a retorting plant is once well under way it will produce its own fuel in sufficient quantity to run the plant. Besides, rich crude oil shale can be used under the boilers in place of coal. The only objection to its use is the large amount of resultant ash.

Colorado Shales Richest in World

The main deposits occur in Garfield, Rio Blanco and Mesa counties If due consideration is given to all the factors involved in estimating the full value of oil shale deposits—richness of the shale, superficial extent, thickness of beds, accessibility, natural sites for retorts, water supply, cheap mining and nearness to railroads—it must be admitted that Colorado owns the richest oil shale deposits in the world.

Distribution of Oil Shale

Entrance to the deposits are from the towns of Rifle, Grand Valley and De-Beque on the western slope. The main deposits are in the Book Cliffs on the banks of Parachute Creek, north of Grand Valley, and on the banks of Roan, Conn, Kimball and Dry Fork creeks, north of De-Beque. The enormous showing can be realized from the fact that on the banks of Parachute Creek and its tributaries there is exposed a ledge of shale from 12 to 20 feet thick for a total distance of 69 miles.

There are apparently no serious difficulties in the way of mining the oil shale deposits of Colorado. The beds are virtually horizontal and high above the beds of the adjacent creeks. If underground mining is necessary the room and pillar method of coal mining will naturally be adopted. However, in many favorable localities the entire face of the cliff, from the top of the retorts up, is composed of shale of commercial value. In such cases the whole side of the bluff will be blasted away and sent to the retorts at once. With such economic advantage the cost of mining will be remarkably low.

Oil shale land is primarily acquired from the government under the federal mining laws governing placer mining claims. At the present time, however, all shale land advantageously situated has been filed on and is owned by individuals or corporations.

The early success of the industry will depend upon the cost of production and marketability of its main products—not upon its by-products—no matter how fascinating these by-products may now appear.

Shale Industry Has Arrived

The substantial and virtually inexhaustible supply of oil shale—the raw material—will furnish the oil for the future. That the problem of producing oil from shale, in a commercial and economical manner, will be solved by American scientists and technicians is certain and sure. To the uninformed it may seem that the solution is far distant, but to those familiar with the present state of the industry it is confidently believed that the solution has been found and that the industry "has arrived."

Asbestos Fiber

A CIRCUMSTANCE of considerable importance to the asbestos industry has recently been noted in "Asbestos," published by the Secretarial Service, 721 Bulletin Building, Philadelphia, Pa. It is well known that during the years 1915 and 1916 considerable "Cape Blue" asbestos was imported into the United States to supplement the Canadian and Arizona supply. The crude fiber was treated in the same way as Canadian fiber, but in general the product obtained was unsatisfactory. Similar results were obtained when blue asbestos was first used in Europe. In order to overcome the objections of manufacturers, the Cape Asbestos Co., of London, England, the largest producers of blue asbestos, established a spinning plant, and demonstrated that the product is well suited for certain purposes, provided it is properly treated.

In order to build up a reputation for blue fiber in the United States, a new corporation, associated with the Cape Asbestos Co., and known as Asbestos Limited, has recently been chartered under the laws of New Jersey. The offices are at 8 West 40th Street, New York City, and the works at Bound Brook, N. J. It is the purpose of this corporation to prepare all crude blue fiber for carding machines by a special process which it is claimed is more satisfactory than methods formerly employed in this country. The prepared fiber will be sold to manufacturers. The establishment of this plant marks an important step in the development of a blue asbestos industry in the United States. While blue asbestos can not be substituted for white fiber for all purposes, it is well adapted for certain uses, and its wider use would tend to relieve the present critical shortage of Canadian crude.—(Oliver Bowles; U. S. Bureau of Mines, Reports of Investigations.)

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.			1.40 per net ton, all sizes			
Burlington, Vt.	1.00		2.50	2.00	2.00	
Chaumont, N. Y.		1.75	1.65	1.35	1.25	1.25
Coldwater, N. Y.	1.80	1.80	1.80	1.65	1.65	2.00@2.40§
North Leroy and Akron, N. Y.	1.00	1.00	1.00	1.00	1.00	1.00‖
Utica, N. Y.	1.00		All other sizes 1.50			
CENTRAL:						
Alden, Ia.	.80	1.50	1.50	1.45		
Alton, Ill.	2.00	1.50	1.50	1.50	1.50	
Bettendorf, Ia.			1.50 per cu. yd., all sizes			
Chicago, Ill.	1.20	1.60	1.30	1.20	1.30	1.20
Cincinnati, Ohio		2.00	2.00	2.00		
Cleveland, Ohio		2.40	2.20	2.20		
Davenport, Ia.	1.50*	1.50*	1.50*	1.50*		
Dundas, Ont.	.75	1.50	1.50	1.35	1.25	1.20
Eden and Knowles, Wis.	1.20	1.20	1.20	1.20	1.20	
Elmhurst, Ill.	1.00@1.25	1.00@1.25	1.00@1.25	1.00@1.25	1.00@1.25	1.00@1.25
Ft. Wayne, Ind.	1.60	1.90	1.90	1.80	1.60	1.60
Greencastle, Ind.	1.25	1.25	1.10	1.10	1.10	1.10
Hull, Canada	2.50	2.30	2.50	2.10	2.00	1.75
Illinois, Southern	2.00	1.50	1.50	1.50	1.50	
Kokomo, Ind.	1.15	1.25	1.25	1.20	1.10	1.10
Krause, or Columbia, Ill.	1.80	1.30	1.50	1.40	1.30	1.30
Laumon, Wis.	1.25	1.25	1.25	1.25	1.25	1.25
Lima, Ohio	1.40	1.40	1.40	1.40	1.40	1.40
Mansfield, Ohio	1.70	2.20	2.00	1.90	1.70	1.70
Mayville, Wis.	.90@1.00	1.35@1.50	1.10@1.20	1.10@1.20	1.10	1.10
Oshkosh, Wis.			1.40 per ton, all sizes			
River Rouge, Mich.	1.25	1.50	1.50	1.50	1.50	1.50
Silica, Ohio	1.00	1.50	1.30	1.20	1.00	1.00
St. Louis, Mo.	.60	1.60				
Stone City, Ia.			1.70	1.60	1.50	
Toledo, Ohio, f. o. b. cars	1.60	2.10	1.90	1.80	1.60	1.60
Toronto, Canada	1.55	2.25	2.25	2.25	2.05	2.00
Winnipeg, f.o.b. cars	2.50*	1.85*	2.85*	2.50*		
SOUTHERN:			These prices include 90c freight			
Brooksville, Fla.	1.00			3.00		
Cartersville, Ga.		2.75	2.75	2.75	2.75	2.75
Chickamauga, Tenn.	1.50	1.75	1.75	1.75	1.75	1.75
El Paso, Tex.	1.00	1.00	1.00	1.00		
Fort Springs, W. Va.	1.25	1.45	1.85	1.75	1.50	1.40
Mascot, Tenn.		1.50	1.50@1.75	1.50@1.75	1.50@1.75	
Memphis Jct., Ky.			1.10@1.35, all sizes			
New Braunfels, Tex.	.60	1.75	1.65	1.50	1.50	1.50
WESTERN:						
Atchison, Kans.	.50	2.00	2.00	2.00	1.90	1.90
Blue Springs and Wymore, Neb.	.25	1.75	1.75	1.65	1.55	1.50
Kansas City, Mo.	.60	2.00				
Mankato, Minn.				1.75	1.50	
Terminous, Calif.		1.00			.90	

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Bernardsville, N. J.	2.00	2.00	2.00	1.80	1.50	
Branford, Conn.	.80	1.75	1.65	1.45	1.25	
Birdsboro, Pa.	1.40	1.90	1.80	1.60	1.40	1.40
Bound Brook, N. J.	2.00@2.10	2.20@2.30	2.00@2.10	1.80@1.90	1.40@1.50	
Dresser Jct., Wis.	.75	2.45	2.45	2.15	2.00	2.00
Duluth, Minn.	1.00	2.25	2.00	1.50	1.50	
E. Summit, N. J.	2.10@2.20	2.35@2.50	2.10@2.20	1.80@1.90	1.75@1.80	
Glen Mills, Pa.	1.00	1.35	1.70	1.55	1.35	1.35‖
Millington and Paterson, N. J.	1.80	2.20	2.00	1.80	1.60	
New Britain, Middlefield, Rocky Hill, Meriden, Conn.	.60@1.00	1.60@1.80	1.60@1.80	1.40@1.50	1.20@1.30	
Westfield, Mass.	.60	1.35	1.30	1.20	1.10	

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Dundas, Ont.—Flint	1.10	1.10	1.10	1.10	1.10	1.10
Mayville, Wis.	.90@1.00	1.10@1.25	1.10@1.25	1.10@1.25	1.10@1.25	1.10@1.25
Middlebrook, Mo.—Granite	4.00	2.00	2.00			1.50‡
Portland, Maine—Granite	1.50			1.35	1.25	
Roseburg, Ore.		1.50	1.25	1.05	1.00	1.00
Stockbridge, Ga.—Granite	.50	2.00	1.90	1.75	1.75	
White Haven, Pa.—Sandstone	.85	1.20	1.40	1.20	1.20	1.20‖
Granite	1.25		1.50	1.50	1.50	

*Cubic yard. †Agrl. lime. ‖R. R. ballast. §Flux. ‡Rip-rap. a 3-inch and less.

Agricultural Limestone

EASTERN:

Coldwater, N. Y.—Analysis, 56.77% $CaCo_3$, 41.74% $MgCo_3$—70% thru 200-mesh, 95% thru 40-mesh; bags, $5.00; bulk 3.25

Chaumont, N. Y.—Analysis: $CaCo_3$, 92 to 98%; $MgCo_3$, 1.51%—(Thru 100 mesh); sacks, 4.00; bulk..... 2.50

Grove City, Pa.—Analysis: $CaCo_3$, 94.75%; $MgCo_3$, 1.20%—(70% thru 100 mesh); 80 lb. ppr., 4.60; bulk..... 3.25

Grove, Md.—90% thru 4 mesh; bulk.... 3.00

Hillsville, Pa.—Analysis, $CaCo_3$, 96% (70% thru 100 mesh); sacks, 4.50; bulk 2.75

Jamesville, N. Y.—68% thru 100 mesh; 95% thru 50; 100% thru 20. Sacks, 3.75; bulk 2.25

Syracuse, N. Y.—Analysis, 90% carbonates (50% thru 100 mesh, 90% thru 50 mesh); sacks, 3.50; bulk..... 1.75

Walford, Pa.—(70% thru 100 mesh; 85% thru 50; 50% thru 50; 100% thru 4); sacked, 4.25; bulk..... 2.75

West Stockbridge, Mass.—Analysis: Combined carbonate, 95%—33% thru 200 mesh; 66% thru 100; 100% thru 40. Bulk 2.85

Williamsport, Pa.—Analysis, $CaCo_3$, 88-90%; $MgCo_3$, 3-4%—(50% thru 50 mesh); bulk..... 4.00

CENTRAL:

Alden, Ia.—Analysis, $CaCo_3$, 99.16%; bulk ..... .80

Alton, Ill.—Analysis: $CaCo_3$, 96%; $MgCo_3$, 0.75%—50% thru 4 mesh..... 2.50

Bedford, Ind.—(90% thru 10 mesh) Analysis, $CaCo_3$, 98.5%; $MgCo_3$, 0.5% 1.75

Belleville, Ont.—Analysis, $CaCo_3$, 90.9%; $MgCo_3$, 1.15% (45 to 50% thru 100 mesh; 61 to 70% thru 50 mesh); bulk 2.50

Chicago, Ill.—Analysis, $CaCo_3$, 53.63%; $MgCo_3$, 37.51%—90% thru 50 mesh 1.00

Columbia, Ill., near East St. Louis (⅛" down) ..... 1.25@1.80

Ellettsville, Ind.—Analysis, Carbonate, 98% 2.00

Elmhurst, Ill. — (Analysis, $CaCo_3$, 35.73%; $MgCo_3$, 20.69%) 50% thru 50 mesh 1.25

Greencastle, Ind.—(Analysis, $CaCo_3$, 98%) 50% thru 50 mesh..... 1.75

Howenstein, O.—100% thru 10 mesh; 59% thru 50; 39% thru 100..... 2.75@3.00

Kansas City—(50% thru 50 mesh)..... 2.00

Lannon, Wis.—(90% thru 50 mesh) Analysis, 54%, $CaCo_3$; 44%, $MgCo_3$ 2.00

Marblehead, O.—(Analysis: $CaCo_3$, 95.33%) 100% thru 100 mesh, sacks, 4.75; bulk 2.75

McCook, Ill.—Analysis, $CaCo_3$, 54.10%; $MgCo_3$, 45.04%—100% thru ¼-in. sieve; 78.12% thru No. 10; 53.29% thru No. 20; 38.14% thru No. 30; 34.86% thru No. 50; 22% thru 100 1.50

Milltown, Ind.—Analysis, $CaCo_3$, 94%; $MgCo_3$, 3%—(100% thru 4 mesh).... 1.50

Montrose, Ia.—(90% thru 100 mesh).. 1.25

Muskegon, Mich.—(90% thru 50 mesh) Analysis, $CaCo_3$, 53.35%; $MgCo_3$, 43.27% 2.50

Piqua, O.—Analysis: $CaCo_3$, 82.8%; $MgCo_3$, 8.2%; neutralizing power in terms of calcium carbonate, 95.3%—50% thru 100 mesh; bulk..... 2.75@4.50

Rockford, Ill. 1.50

Stolle, Ill. (near East St. Louis on I. C. R. R.)—(Thru ¼" mesh) Analysis, $CaCo_3$, 89.61 to 89.91%; $MgCo_3$, 3.82% 2.00

St. Paul, Ind.—Analysis, $CaCo_3$, 85%; $MgCo_3$, 12% 1.50

Stone City, Ia.—Analysis, $CaCo_3$, 98% (50% thru 100 mesh)..... .80

Toledo, O.—Analysis, $CaCo_3$, 52.72%; $MgCo_3$, 43%—(20% thru 100 mesh); 30% thru 50; 80% thru 100; 100% thru 5/32 screen)..... 1.80

Whitehill, Ill.—Analysis, $CaCo_3$, 96.12%; $MgCo_3$, 2.50%—50% thru 100 mesh..... 2.00

(Continued on next page.)

Agricultural Limestone

(Continued from preceding page.)

SOUTHERN:

Cartersville, Ga.—Analysis: 96 to 98% combined carbonates — All thru 10 mesh with all dust in 2.75

Claremont, Va. (Marlime) — Analysis, 90.94% $CaCo_3$, 0.31% P., 1.36% Mg., 0.37% K.; bulk 4.50
100 lb. ppr. bags 6.00
100 lb. cloth bags 6.50

Dittlinger, Tex. — Analysis, $CaCo_3$, 99.09%; $MgCo_3$, .04%.
90% thru 100 mesh 2.00
90% thru 4 mesh 1.00

Grovania, Ga.—Analysis, $CaCo_3$, .95%; $MgCo_3$, none—50% thru 100 mesh 2.50

Hopkinsville, Ky.—Analysis, 94.6 to 98.1% $CaCo_3$—Bulk 2.00

Linnville Falls, N. C. — Analysis, $CaCo_3$, 54%; $MgCo_3$, 42%—50% thru 100 mesh; sacks, 4.00; bulk 2.50

Marion, Ga.—Analysis, 90% $CaCo_3$—(50% thru 100 mesh) 2.00

Memphis Jct., Ky.—(Analysis, $CaCo_3$, 95.31%; $MgCo_3$, 1.12%); average price, ⅛ in. down 2.00

Mascot, Tenn.—Analysis, $CaCo_3$, 52%; $MgCo_3$, 38%.
(80% thru 100 mesh) 2.75
(All thru 10 mesh) 2.25
(80% thru 200 mesh) 4.00
Paper bags, $1.50 extra per ton; burlap, 2.00 extra per ton.

Maxwell, Va. 2.50

Mountville, Va.—Analysis, $CaCo_3$, 76.6%; $MgCo_3$, 22.8%—100% thru 20 mesh; sacks, 6.00; bulk 5.00

Ocala, Fla. — Analysis, $CaCo_3$, 98%—(75% thru 200 mesh) 4.50

Tyrone, Ky.—Analysis, $CaCo_3$, 90%; $MgCo_3$, 4%—90% thru 4 mesh ..... 1.75@2.25

Winnfield, La.—(50% thru 50 mesh) 3.00

WESTERN:

Cement, Calif.—50% thru 50 mesh 4.00

Colton, Calif.—Analysis: $CaCo_3$, 95%; $MgCo_3$, 1½% (all to pass 14 mesh) —bulk, 3.50; bags 4.50
Sacks, 15c extra, returnable.

Kansas City, Mo., Corrigan Sid'g—50% thru 50 mesh; bulk 1.35

Terminous, Calif.—Analysis, 94% $CaCo_3$, 1.4% $MgCo_3$—(60% thru 200 mesh; 90% thru 100 mesh; 100% thru 40 mesh); sacks, 6.00; bulk 5.25

Miscellaneous Sands

Silica sand is quoted washed, dried and screened, unless otherwise stated.

GLASS SAND:

Berkeley Springs, W. Va. ..... 2.50@3.00
Special hand selected rock 2.50
Bridgeton, N. J. 2.00
Cedarville and South Vineland, N. J.—
Glass, damp 2.00
Glass, dry 2.50
Gray Summit, Mo. ..... 2.50@3.00
Guion, Ark.—Carlots 2.50
Hancock, Md.—Damp 2.00
Klondike and Pacific, Mo.:
Contracts 2.00
Carlots 3.00
Mapleton, Pa. 3.00
Glass, damp 2.50
Massillon, Ohio 3.50
Michigan City, Ind. ..... .75
Millington, Ill.—Contracts 2.00
Mineral Ridge, O. 3.50
Montoursville, Pa.—Green, washed ..... 2.00@2.75
Oregon, Ill.—Large contracts 2.00
Open market 2.50
Ottawa, Ill. ..... 2.00@2.50
Robinson, Md., washed, screened, not dried 2.00
St. Marys, Pa.—Green 2.50
Sands, Elk Co., Pa.—Selected, green 2.75
Thayers, W. Va.—Washed 2.75
Unwashed 2.50
Utica, Ill. ..... 1.75@2.50

FOUNDRY SAND:

Albany, N. Y.—Core ..... 1.25@2.00
Furnace lining ..... 2.25@2.50
Molding, fine coarse and brass ..... 2.50@2.75
Sand blast ..... 3.75@4.50
Allentown, Pa.—Core ..... 1.50@1.75
Molding coarse 1.50
Arenzville, Ill.—Molding fine ..... 1.75@2.00
Beach City, Ohio—Core 2.75
Furnace lining and sand blast 3.00
Molding fine and coarse ..... 2.50@3.00

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
EASTERN:						
Ambridge, South Heights, Pa.		1.30		1.30	1.00	1.00
Attica, N. Y.	.75	.75	.75	1.00	1.00	1.00
Farmingdale, N. J.	.68	.48	1.50	1.35	1.35	1.30
Hartford, Conn.	.90		1.25	1.15	1.15	1.15
Leeds Junction, Me.		.50@ .60	1.75@2.00	1.50		1.35
Ludlow, Mass.		.75			1.10	1.00
Morristown, N. J.	.60	.60	1.75		1.40	1.35
Washington, D. C., f. o. b. wharves on cars	.75	.75	2.00	1.40	1.20	
CENTRAL:						
Alton, Ill.	.60@ .75	.60@ .75	1.50@4.50	1.30	1.20	1.20
Attica, Covington, Silverwood, Ind.	.85	.85	.85	.85	.85	.85
Barton, Wis.	.85	.70	1.00	.80	.80	.80
Chicago, Ill.		1.20@1.50		1.20@1.50		
Columbus, Ohio		.70	.70	.80	.80	.70
Covington, Ind.	.75	.75	.85	.75	.75	.75
Des Moines, Ia.	.75@1.00	.75	1.65	1.65	1.50	1.50
Earlestead (near Flint), Mich.	.60	.60				.70
Eau Claire, Wis.		.60@ .70		1.25@1.50		1.00@1.25
Elgin, Ill.		.80	1.00	.80	.80	.80
Elkhart Lake, Wis.	.60	.60	1.00		.84	
Ft. Jefferson, Mechanicsb'g, O.	.70	.60	.60	.80	.70	.70
Grand Rapids, Mich.		.60		.90	.83	
Greenbush, Mich.	.50	.80	1.00	1.25	1.25	
Indianapolis, Ind.	.60	.60		1.50	.75	.75
Mason City, Ia.	1.00	.90	2.00	1.85	1.75	1.65
Milwaukee, Wis.	1.25	1.25	1.35	1.35	1.35	1.35
Minneapolis, Minn.	.50	.50	2.00	2.00	1.75	1.75
Moline, Ill.	.80	.80		1.20	1.20	1.20
Oxford, Mich.			(60-40 mix, .95 per ton)			
Pittsburgh, Pa.			(Sand, 1.30; gravel, 1.00)			
Saginaw, Mich., f. o. b. cars	1.30	1.30	2.20	1.95	1.85	1.85
St. Louis, Mo., f.o.b. cars	1.50	1.55		1.50		1.45
Summit Grove, Ind.	.85	.85	.85	.85	.85	.85
Terre Haute, Ind.	.85	.85		.90	.90	.85
Toledo, Ohio	.75	.75				
Winnipeg, f. o. b. cars			2.00 per cu.yd.			
Yorkville, Moronts, Oregon and Ottawa, Ill.	.70	.80	.90	.80	.80	.75
SOUTHERN:						
Knoxville, Tenn.	1.15	1.15	1.50	1.50	1.50	1.40
Lake Weir, Fla.		.75				
Lincoln, Neb.	.90	.90	2.20	2.20		
Macon, Ga.		1.00				
Memphis, Tenn.	1.40	1.40	1.50			1.50
N. Martinsville, W. Va.		1.20@1.30				1.00@1.10
New Orleans, La.	.75	.75	2.50		1.50	1.50
Pelzer, S. C.	.80					
Pine Bluff, Ark.	1.25	.92	Concrete gravel, all sizes, 2.00			
Pueblo, Colo.	.95*	.75*			1.50*	2.00*
Roseland, La.		.35			1.25	
Tulsa, Okla.		.70				
Waco, Texas	.70@ .80	.70@ .80				1.10
WESTERN:						
Grand Rapids, Wyo.	.50	.50	.85	.85	.80	.80
Kansas City, Mo.			(Kaw River sand, car lots, .75 per ton, Missouri River, 1.50)			
Saratoga, San Jose, Calif.		.60@ .75	.60@ .70	.60@ .70	.60@ .70	.60@ .70
Seattle, Wash.	1.25	1.25	2.00	1.25	1.25	1.25
Vancouver, B. C.		1.30*		1.30*		1.10*
Yorkville, Ore.	.60	.60@ .75	.70	.60@ .75	.60	.50@ .60

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
EASTERN:						
Boonville, N. Y.	.60@ .75	.60@ .75	1.20	1.10	1.00	.90
Burnside, Conn.	.80*					
Fishers, N. Y.		.85@1.00			.85@1.00	
Yardville, N. J.		.50@ .75				
York, Pa.		1.10@1.30		(crushed rock sand)		
CENTRAL:						
Earlestead, (near Flint, Mich.)			.60 per yd.			
Ft. Jefferson, Mechanicsb'g, O.	.70	.60	.60			
Grand Rapids, Mich.		.40		.75	.80	.60
Greenbush, Mich.	.65					
Hersey, Mich.				.60		
Illinois, Northern						.50@ .60
Janesville, Wis.		.65			.75	
Lincoln, Neb.			Sand gravel mix, 1.30			
Moline, Ill.		.80				1.00
Oxford, Mich.			Including cobbles, $1.00 per yd.			
Saginaw, Mich., f. o. b. cars		.75	1.30	1.30	1.30	1.30
St. Louis, Mo., f.o.b. cars	1.60	1.60	1.60	1.60	1.60	1.60
Summit Grove, Ind.	.65	.65	.65	.65	.65	.65
Toledo, Ohio					.75	
Yorkville, Oregon, Moronts and Sheridan, Ill.						.65
SOUTHERN:						
Albany, Ga.	.70@1.00					
Dudley, Ky. (Crushed Sand)		1.05		1.00		
Lindsay, Tex.					.50	
Valde Rouge, La.						.60@ .75
Waco, Texas						.95
WESTERN:						
Pueblo, Col.			River Run, .75* unscreened			
Saratoga, San Jose, Calif.		.60@ .75	.60@ .70	.60@ .70	.60@ .70	.60@ .70
Yorkville, Ore.		.40			.40	

* Cubic yard. B Bank. L Lake. || Ballast.

Crushed Slag

City or shipping point	Roofing	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:							
Bethlehem and Emaus, Pa.	2.50	.90	1.50	1.00	1.00	1.00	1.00
Buffalo, N. Y.	2.00	1.00	1.00		1.00	1.00	1.00
Cleveland, Ohio.		.85		1.05	1.05	.95	.95
E. Canaan, Conn.	4.00	1.10	2.00	1.50	1.50	1.35	
Erie, Pa.		1.25	1.25		1.25	1.25	1.25
Emporium, Pa.		1.25	1.25		1.25	1.25	1.25
Ensley, Ala.	2.05	1.00	1.25	1.25	1.25	1.00	.95
Hokendaugua and Donaghmore, Pa.	2.50	.90	1.50	1.00	1.00	1.00	1.00
Lebanon, Pa.	2.50	.85	1.50	.85	.85	.85	.85
Philadelphia Dist.	2.50	1.20	1.50	1.20	1.20	1.25	1.25
Pittsburgh, Pa., Dist.	2.05	1.15	1.50	1.15	1.15	1.15	1.15
Sharpsville and Struthers, Pa.	2.00	1.20	1.60	1.20	1.20	1.20	1.20
CENTRAL:							
Chicago, Ill.	All sizes, $1.50, F. O. B. Chicago						
Detroit, Mich.	All sizes, 1.65, F. O. B. Detroit						
Ensley, Ala.	2.05	1.00	1.10	1.25	1.25	1.00	.95
Ironton and Jackson, O.	2.00	1.25	1.60	1.25	1.25	1.25	1.25
Toledo, O.	All sizes, 2.00, F. O. B. Toledo						
Youngstown, Dover, Hubbard and Leetonia, O.	2.00	1.20	1.60	1.20	1.20	1.20	1.20

Agricultural Lime and Hydrate

	—Agricultural Lime— Bulk	Bags	Per Cent CaO	Per Cent MgO	Agricultural Hydrate Bags
EASTERN:					
Adams, Mass.			98	38	8.00
Bellefonte, Pa.	8.00		98.5	.72	11.50
Berkeley, R. I.		14.00	45	15	
Bridgeport, Pa.	7.50@9.00		55	44	9.00@11.00
Cavetown, Md.	8.50				
Cedar Hollow, Devault, Rambo and Swedeland, Pa.	8.00	10.75 grd.	58	38	10.75
Chippewa, Pa.	6.00		78.67	1.33	
Farnams, Mass.	6.00	7.50	60	2	
Frederick, Md.	7.75		88	5 to 8	10.50
Grove, Md.	8.00				10.75
Highgate Springs, Vt.		8.00	85	2	
Hollidaysburg, Pa.	5.50@7.50		94.68		
Hyndman, Pa.	5.00	8.50	80.23	2.87	
Lime Kiln, Md.	8.00	10.75			10.75
Lime Ridge, Pa.	5.25@6.50		80.56-62.56	3.87-1.75	
Newburgh, N. Y.			57	38	8.00
New Castle, Pa.	3.50	4.50	47.6 to 50.4	0.62 to 1.12	
Rosendale, N. Y.	8.00	9.00	92	5	
Sandyville, O.					9.00
Union Bridge, Md.	8.50		73	1	10.75
Williamsport, Pa.	6.50		62-68	2-3	11.00
York, Pa.	8.00		90-95	2-7	10.75
CENTRAL:					
Alton, Ill.	10.50		94.0		
Delaware, O.			50.0	5-12	10.50
Forest, O.	7.50				
Knowles, Wis.		9.00	55	45	11.50
Manistique, Mich.	11.00		95	2	11.00
Mitchell, Ind.					12.50
Sheboygan, Wis.	5.50	8.50	58	40.5	
Springfield, Ohio			33.62	17.73	10.50
Woodville, Ohio			46-50	30-35	13.00
SOUTHERN:					
Blowers, Fla.	5.00	7.25	98.0		
Burns, Tenn.	9.50		96	0.54	13.00
Chippewa, Fla.	5.00		80.0	15.0	
Dittlinger, Texas		9.00@11.00	98.62	0.29	12.50@15.00
Erin, Tenn.	9.50		97.82	0.12	
Knoxville, Tenn.	2.50				14.00
Lushing, Va.	9.00	11.25	60	15	12.75
Maxwell, Va.	6.00	9.00	88	1.75	
Newala, Ala.	8.50@9.00		99.33		
Ocala, Fla.	4.00	6.00 pulv.	98½ (dry basis)		
Staunton, Va.	7.50	10.00	80.00	15.00	
WESTERN:					
Colton, Calif.	4.50		97	2	15.00
Kirkland, N. Mex.	15.00				
San Francisco, Calif.			96	0.33	15.00
Tehachapi, Cal.	6.00	8.00	96	2	

Miscellaneous Sands

(Continued from preceding page)

Bowmantown, Pa.—Core	**1.50**
Molding, coarse	**2.00**
Bridgeton, N. J.—Core	**2.00**
Cleveland, O.—Molding coarse	2.50
Brass molding	2.50
Molding fine	2.00@2.50
Core	1.50@2.00
Columbus, O.—Core	**2.00**
Brass molding	**2.50**
Molding fine, steel molding	**2.50**
Conneaut, O.—Molding fine	2.25@2.50
Molding coarse	2.00@2.25
Delaware, N. J.—Molding fine	2.00
Molding, coarse	1.90
Brass Molding	2.15
Eau Claire, Wis.—Core	.70
Roofing gravel	2.25
Sand blast coarse	3.50
Sand blast medium, fine	3.00
Fleetwood, Pa.—Furnace lining	**2.25**
Franklin, Pa.—Traction	2.25
Brass molding	2.25
Molding fine, steel molding	**3.00**
Molding coarse, fine, green	2.25
Sand blast	**5.00**
Core	2.25
Greenville, Ill.—Molding coarse red	1.75@2.25
Guion, Ark.—Molding fine	2.00@2.25
Roofing	3.00
Stone sawing	2.50
Hancock, Md.—Core and brass mldg.	1.65
Hellam, Pa.—Core	2.00@2.50
Joplin, Mo.—Stone sawing, flint	**1.25**
Kansas City, Mo.—Missouri River core	**.85**
Klondike and Gray Summit, Mo.—Molding fine	**2.00@2.50**
Lake Weir, Fla.—Sand blast	.60
Mapleton, Pa.—Core, furnace lining, molding fine and coarse damp	2.50
Core, furnace lining, molding, fine and coarse, dry	3.00
Massillon, O.—Molding fine	3.00
Molding coarse	3.00
Traction	3.00
Furnace lining	3.50
Core	3.00
Michigan City, Ind.—Core, bank	.75
Traction	.50
Millington, Ill.—Core and furnace lining	2.50
Core, washed	**1.50**
Mineral Ridge, O.—Core, molding sand blast, roofing, etc., washed, screened (damp)	2.50
Montoursville, Pa.—Traction	1.50@2.00
Brass molding, fine	1.75@2.25
Ohio—Various points:	
Iron molding, fine	1.50@2.25
Iron molding, coarse	1.75
Brass molding, minimum	2.00
Oregon, Ill.—Core, furnace lining, molding fine, brass molding	2.50
Sand blast, molding coarse	3.50
Ottawa, Ill.—Sand blast	3.50
Furnace lin'g, mold'g fine and coarse	2.25
Core, roofing and stone sawing	2.00
Providence, R. I.—Molding fine	2.00
Molding coarse	**1.90**
Brass molding	**2.25**
Sand blast	3.00@4.00
Sugar Grove, Ohio—Core (dried and screened)	**2.00**
Traction	**2.00**
Thayer, Pa., Traction	2.00
Furnace lining, molding, coarse	1.25
Molding, fine	1.50
Core, washed	2.50
Core, green	2.00
Utica, Pa.—Core	2.00
Molding coarse, traction	2.50
Brass molding	2.75
Sand blast	3.50
Warwick, Ohio—Core, furnace lining, molding fine and coarse (dry and screened)	2.50@2.75
Core, furnace lining, molding fine and coarse (green)	2.25
Wedron, Ill.—Core, (crude silica)	.75@1.00
Molding fine, coarse	.75@1.00
West Albany, N. Y.—Molding fine	1.75@2.25
Molding coarse	**1.50**
Brass molding	**1.75**
Zanesville, Ohio — Molding fine and brass	2.00@2.50
Molding coarse	1.75@2.25

Gypsum, per Ton

Castalia, O.—Crushed, to cement mills	**3.50**
Ground, to cement mills	**3.50**
Land plaster	**6.00**
Bags extra—Jute, 3.00; ppr., 1.00 per ton.	
Fort Dodge, Ia., bulk	**3.50**
Garhutt, N. Y.—Land plaster, bags	7.50
Grand Rapids, Mich.—Crushed gypsum	4.50
Ground gypsum rock	**9.00**
Gypsumville, Man., Can. (crushed)	3.50
Oakfield, N. Y.	7.50
Sandusky, O.	6.00
Jute sacks, $3.00 extra; paper, $1.00 extra.	

Ground Rock Phosphate

Centerville, Tenn.—B. P. L., 70%; ton, 2000 lbs. (90% thru 100 mesh)	10.00
Lump rock, 72% to 75%, B. P. L.	6.00@8.50
Centreville, Tenn.—B. P. L., 65%	8.25
B. P. L., 70%	9.00@10.00
Gordonsburg, Tenn.—2000 lbs. (90% thru 100 mesh)—B. P. L., 60%	6.00
B. P. L., 65%	7.00
B. P. L., 70%	8.50
B. P. L., 75%	12.00
Mt. Pleasant, Tenn.—(B. P. L. 68%) 13%	7.00
14%	8.00
Mt. Pleasant, Tenn.—B. P. L., 70%	9.00@10.25
Nichols, Fla.—Pebble, B. P. L., 68%	10.00
Wales, Tenn. (95% thru 100 mesh) (guaranteed 14% phosphorus equivalent)	7.00@8.25
Walls, Tenn.—B. P. L., 70.2%—To County Agri. Assns	7.50
To others	7.75

Florida Soft Phosphate

Croon, Fla.—Ground pebble, 30%	16.00
Pulverized soft, 26%	17.50
Jacksonville (Fla.) District	10.00@12.00
(Add 2.50 for sacks)	
Phoslime, Fla. (in burlap bags, 100-200 lbs.)	15.00

General News from Rock Products Markets

Proposed Uniform Lime Law

THERE HAS recently been prepared and sent out by the National Lime Association, for comment and criticism, a tentative agricultural lime inspection law, proposed for adoption in all states administering such regulations.

The farmer is concerned to know the amount and availability of the essential liming constituents in the material he purchases. Much of this information is not provided for by statute in any of the laws now in force. On the other hand, lime companies actively engaged in the field of producing agricultural lime and especially in selling their product in more than one state, are often hampered by the limitations and inconsistencies between the laws in the several states.

The proposed uniform law in all states would seem to be a first step in the direction of a generally satisfactory law on this subject. It is hoped that by a careful study of the tentative draft recently sent out, both on the part of producers and also on the part of agricultural officials, the best possible form of law may evolve and that all available suggestions may thus be embodied in a final draft that will be acceptable to those states having such regulations.—The National Lime Association Report.

Order Permits Railroad to Move Spur

HARRISBURG, Pa.—The Public Service Commission handed down an order in the case of Conrad Schuck, coal, sand and gravel dealer of West Liberty Station, against the West Side Belt Railroad Co. and J. B. Yohe, who was manager under federal control, according to the Pittsburgh Telegraph.

Schuck asked that the commission restrain the railroad from removing the spur connecting the complainant's chutes and bins with the West Side Belt road and from interfering with his use of the spur. He also asked that in event the commission decided the removal of the spur was essential to the conduct of the road, that the company be ordered to install proper connections between the road and Schuck's chutes and bins.

The commission, in its decision, held the removal of the spur was essential to the conduct of the road, but ordered that the respondent construct a switch connection for the complainant at a point just west of the switching connection of the West Liberty Lumber Co. or at a point further west, near Warburton street, Pittsburgh. The present spur is to remain until the new switching connection is made, according to the order.

Attend Meeting of National Lime Association

THE NEXT annual meeting of the National Lime Association will be held at the Hotel Astor in New York City, June 17 and 18. This meeting will be the big convocation of the lime industry for the year. The heavy demand for lime for all types of use, the critical car supply situation, and the need for constructive educational publicity touching lime, all of which will be actively considered by the convention, will make the convention well worth the time of every progressive manufacturer of lime in the country to attend this meeting.

Five Big Sand and Gravel Companies Consolidate

IT HAS BEEN officially announced through Harry Donnelly that the Ohio Gravel Ballast Co. is the name of a new Ohio sand and gravel company which operates five plants. Mr. Donnelly, who is vice-president and general manager of the new company, with main offices at 2103-2106 Union Central Building, Cincinnati, Ohio, says that on April first this new company was incorporated.

It will operate the sand and gravel plants formerly owned and operated by the Miami Stone & Gravel Co., Miami Grove, Ohio; the Cincinnati Crushed Stone and Gravel Co., Miamiville, Ohio; the Ohio Ballast Co., Gravel Pit, Ohio; the Trenton Sand & Gravel Co., Trenton, Ohio, and the Greenville Gravel Co., Cincinnati, Ohio.

This extensive operation will make the Ohio Gravel Ballast Co. the second largest in the state of Ohio and one of the largest in the whole country. All of these plants are large and well equipped to produce large quantities of good, clean material.

Harry Donnelly, the vice-president and general manager, is well known among sand and gravel producers of the country because of his extensive activities in both the National and Ohio sand and gravel producers' associations, having been president of the national association during the past several years.

New Slogan for Association

THE NATIONAL Crushed Stone Producers' Association has been making wide use of a slogan which, though short, exactly hits the spot and has met with considerable approval.

"United we stand;
Divided we're stuck."

This was coined by O. C. Hubbard, executive secretary of the Wisconsin Mineral Aggregates Association.

Effect of Export of Coal on Car Supply

A FEW producers are aware, but most are not fully acquainted with all that is being done through every possible agency to combat the activity of the coal producers and distributors in securing preferential movement of open-top equipment which, if accomplished, of course will shut down the mineral aggregate producers' operations.

In addition to a very efficient organization, the coal people are in a position to quickly create public sentiment and the aid of public officials and civic bodies to assist them on account of the very nature of their business. While there is apparently a slight shortage of coal, everything possible has been done to combat the large export of coal, which not only makes a loaded and empty car congestion at seaports, but creates a shortage of both empty equipment and fuel in other localities.

Some idea of the amount of coal produced is interesting:

	Production first 98 working days tons
1917	172,028,000
1918	172,744,000
1919	133,519,000
1920	166,152,000

Based on these figures, if we survived 1919, there should be no particular difficulty in 1920, eliminating an excessive amount of export business.—The Wisconsin Mineral Aggregates Association General Letter.

New Phosphate Shipping Facilities at Fernandina, Fla.

CONSTRUCTION HAS BEGUN at Fernandina, Fla., of a $500,000 plant for the Florida Phosphate Terminal Company, that port always having been the point for extensive shipments of rock. The establishment of the terminal company will permit of an expansion of this business. The terminal will be able to handle several 6,000-ton ships at the same time.

Eastern Lime Bureau Loans Promotion Engineer

ON BEHALF of the National Lime Association, Tyrrell B. Shertzer, engineer in the Eastern Bureau of that organization, is spending the months of May and June in the Middle West and Southern States. While in the field Mr. Shertzer will consider with producers of lime, together with contractors, engineers and architects, the place that lime is coming to occupy in the present industrial situation.

Passed By The Screens

Incorporations

The Spruce Pine Sand & Gravel Co., Wilmington, N. Y., has been incorporated with a capital of $200,000 to deal in sand and gravel, etc.

The Sandusky Limestone Quarries of Cleveland, Ohio, has been incorporated with a capital of $1500. The incorporators are C. A. Pierson and M. A. Smith.

The Lime Co., Boston, Mass., has been incorporated with a capital of $65,000 to deal in lime and to develop a quarry. The directors are E. W. Lewis, president and treasurer; Edward Bryant and E. R. Berry.

The Leathen D. Smith Stone Co., Sturgeon Bay, Wis., has been incorporated with a capital of $200,000 to produce and sell crushed stone. The incorporators are L. D. Smith, T. B. Behringer, and H. W. Ferguson.

The Lynch, McKee & Co., Syracuse, N. Y., has been incorporated with a capital of $50,000 to produce sand and gravel and mineral products. The incorporators are W. G. McKee, C. H. Searl and O. E. Lynch, all of Syracuse.

The Monolith Granite Co., with a principal office in Peekskill, N. Y., has as its directors Samuel J. Rosenfeld, of Peekskill, and Eugene Schmid and Gustave J. Fabian, Jr., of New York. The capitalization is for $250,000.

The Rock Plaster Corporation, a consolidation of the Rock Plaster Manufacturing Co. of New York and the Nova Scotia Gypsum Corp., Manhattan, has been organized and given charter in the state of New dork. The capital is $577,600 and the incorporators are D. Haigh, J. C. Woodhull and R. Moses, of 366 Fifth Ave., New York City.

The Anoka Crushed Stone Co., Columbia Heights (a suburb of Minneapolis, Minn.), has been incorporated to deal in crushed stone and gravel, and to quarry and crush the same. The capital is $100,000 and the incorporators are A. D. Hoar, president; Clyde Gillespie, vice-president; and Chester H. Hoar, secretary and treasurer.

The Westminster Sand and Gravel Co., Lima, Ohio, has been incorporated, with a capital stock of $100,000, to deal in the production of sand and gravel and sale of the materials. Incorporators are B. F. Thomas, W. J. Holland, F. D. Bradley, W. C. Bradley and Earl Betzler. The plant will be located about two miles from Westminster. A storage will be maintained in Lima.

The Federal Crushed Stone Co., Trust Building, Dallas, Texas., has been organized with a capital of $1,000,000. The plant will be at Chico, Texas, and will cost $200,000, and will be constructed by the company. The crushing plant will be modern and fireproof and will have a daily capacity of 2,000 tons of crushed stone per day. The incorporators are Emmett Thurmon, president and treasurer; Frank E. Smalley, vice-president, and Leon Thurmon, secretary.

Sand and Gravel

The Witherbee, Sherman and Co., Port Henry, N. Y., is erecting a rock crusher plant. The entire plant will be electrically operated. The machinery is being moved from a plant at Cheever Mines.

The Charles Warner Co., Wilmington, Del., has purchased the equipment of the Delaware Dredging Co., including boats, barges, cranes, and other apparatus. This equipment will be used for stocks at its extensive local yards, and the company expects to overcome a large measure of the handicap now prevalent. The company reports a difficulty in securing cement, although the stock now on hand is sufficient for immediate call. This concern has recently added five new motor trucks to its fleet, making a total of ten trucks now operated locally. Material is being furnished for operations for many miles around.

The Ely Lake Sand & Gravel Company of Eveleth, Minn., expects to start operations shortly at the pit near Ely lake. As soon as the siding of the D., M. & N. is completed the company will begin quarrying and supplying customers with gravel. Theodore Oakland heads the concern.

Heggie & Company, owners of the gravel pit at Millsdale, Illinois, will reopen the pit in the near future which has been closed all during the war. The Chicago & Alton R. R. maintenance department has received instructions to place the tracks leading to the pit in good condition and reset switches connecting the spurs with the main lines. The Alton formerly used much gravel from the Millsdale pit for ballast purposes and the present heavy demand for sand and gravel for the building of hard roads has convinced the owners that the reopening of the pits will pay well. The old plant will be put in operation as soon as possible.

The Evansville Sand and Gravel Co., Evansville, Ind., submitted a proposition to furnish gravel to Union county in sufficient quantities to meet the present demands. A contract was made by the terms of which the Evansville Sand and Gravel Co. agrees to furnish Union County 6,000 cu. yds. of gravel on the river bank at Uniontown. The gravel is to be delivered not later than July of this year. The price of the gravel is $1.25 per yard. This material will be used to complete the Uniontown-Morganfield public highway. The gravel digger and barges of the Evansville Sand and Gravel Co. was at Grandview, Ind., a short time last week putting 3,500 yards of gravel on the river bank for Titus and Jones Co.

Gypsum Products

The United States Gypsum Co. of Chicago has purchased 200 acres of land out of the A. J. Roe Estate property, located two miles east of Sweetwater, Texas. Practically the entire tract contains heavy beds of gypsum and lies between the tracks of the Santa Fe and Texas & Pacific Railroads.

The Bestwall Plaster Co. and the H. H. Robertson Co., manufacturers of stucco roofing tile and partition blocks, have built plants on property adjacent to the American Gypsum & Cement Plaster Co. at Akron, N. Y. The two new companies will use the stucco manufactured by the American Gypsum & Cement Plaster Co. The two plants were ready to begin manufacturing the first of May. The new buildings are constructed of iron frames covered with fireproof roofing and sheeted with heavy plaster board manufactured by a plaster board company, which is also said to be practically fireproof. The companies have already invested probably $100,000. The factories will be operated and lighted by electricity.

The Arizona Gypsum Co., Phoenix, Arizona, is sufficiently financed to proceed with the installation of a complete gypsum plaster plant, according to a report of the secretary-treasurer of the company, submitted at the annual meeting of stockholders here on Monday. The new company has secured a location to erect their plant, and several carloads of lumber are already on the ground, it was announced. Plans and specifications are being completed and the plant will be completed as rapidly as possible. The products of the company, as planned at present, will consist of all grades of gypsum plaster, solid and hollow building blocks, all sizes; fertilizer, etc. It is estimated that the plant will cost from $25,000 to $30,000 when complete and will have a capacity of 200 tons per day. The stockholders elected a board of directors including J. C. Callaghan, W. M. Owens, T. M. Drennan, A. R. Taverner, C. W. Hartman, Frank H. Swensen of Phoenix, and Dan P. Jones, Charles Peterson and E. P. Grover of Mesa. J. C. Callaghan was elected president; W. M. Owens, first vice president; Charles Peterson, second vice president; T. M. Drennan, secretary, and Theron Fagan, treasurer.

Personals

R. H. Carter has been appointed research chemist of the chemical department of the National Lime Association. In line with the enlarged program of activities now being undertaken by the association, the research chemist will develop a comprehensive series of laboratory studies. Mr. Carter has had a wide experience in teaching and research work and is eminently qualified for this branch of the association work.

Retail Dealers

The Dawley-Northern Yards, Inc., Wausau, Wis., has been incorporated with a capital of $400,000 to deal in and manufacture building material and supplies.

The H. L. Meyer Co., Hilbert, Wis., has been incorporated with a capital of $60,000 to deal in lime, brick, cement, stone, gravel and tile. The incorporators are H. L. Meyer, E. E. Meyer and Rudolph Greve.

The Kimberly Mfg. & Supply Co., Kimberly, Wis., has been incorporated with a capital of $60,000 for the purpose of manufacturing in all kinds of building materials and dealing in cement, lime, sand and gravel, etc.

The Delos Engineering and Construction Co., Prairie du Chien, Wis., has been incorporated with a capital of $10,000 for the purpose of constructing buildings and dealing in all kinds of building material. The incorporators are G. J. Lenst, Peter La Rocque and F. W. Schwerin.

The Concrete Products Co., Muncie, Ind., which was recently organized in that city and is composed of W. W. Bailey, Malcolm Harriot, D. W. Bailey, Noble Catterlain and Roy Swank, who have bought a three-acre tract of land near the Big Four Railroad station in Yorktown and will build a manufacturing plant. Concrete blocks, fence posts and porch columns, together with other concrete articles, will be manufactured. The company also will manufacture the W. W. Bailey fence post machine, a combination mixer and form which was patented recently.

Cement

The Giant Portland Cement Co., main offices at Philadelphia, Pa., and plants at Egypt and Norfolk, Va., voted to defer an improvement and enlargement program at its recent meeting of the board of directors. This program involved an expenditure of $300,000 for new machinery and equipment.

The Edison Portland Cement Co., Easton, Pa., has given its 600 employes an increase of 5 cents per hour. An official of the company expressed himself as well pleased with the outlook for the future. With the exception of a brief shut-down just prior to April 21 the company has been running full strength and full time. This temporary shut-down was due to a shortage of coal.

The Universal Portland Cement Co., at its Buffington, Ind., plant, has loaded its first ship with cement at the East Chicago city dock. The company applied for permission from the board of public works to use the city docks. Until this time the chief commodities shipped have been oil and steel. The cement company has resorted to ships because of the poor freight facilities since the beginning of the switchmen's strike.

The Wisconsin Highway Commission reports that the question of cement supply for road construction, which became acute in January has not modified noticeably. The commission has been able to secure only about 600,000 bbls., or half enough to meet the concrete construction program of 1920. As a result of this the commission has been compelled to take control of the allotment of cement for the present. Cement will be allotted in accordance with the requirements of the counties of their most important work.

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Repaired Contractors' Equipment

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Model 60 Marion Shovels, 2½-yard dippers, Nos. 1999, 2059

1—Model 70 Marion, 2½-yd. dipper, Shop No. 2693.

1—Model O Thew, ½-yard dipper, full revolving, on traction wheels.

Hoisting Engines

1—8½ x 10 DC 2-D Lambert, with boiler

1—6 x 10" DC 2-D Byers.

1—6¼ x 10 DC 2-D Mundy, with attached swinger and boiler

Cableway

1—Lidgerwood Cableway, 1164-ft. span, with 9 x 10" DC Reversible Link Motion Cableway Engine, 3-ton capacity

We have a large stock of thoroughly repaired Construction Equipment of all kinds ready for immediate shipment.

Locomotives

1—14 x 20" standard gauge saddle tank Locomotive.

2—American 10 x 16" Locomotives, 36" gauge, with butt joint boilers

4—18-ton 10 x 16" Dinkeys, 36" gauge

Clam Shell Buckets

1—1½-yard Browning.

Cars

20—12-yard Western Air Dump, standard gauge, 26 ft. bed.

H. KLEINHANS COMPANY

Union Arcade **Pittsburgh, Pa.**

NEW STANDARD GAUGE DUMP CARS

90—20-yard capacity standard gauge Magor air-dump cars. These are new cars, built for U. S. Government, steel construction throughout, with wood floors.

67—12-yard capacity standard gauge Western Wheeled Scraper Company's Cars. These are new cars built for U. S. Government, latest type construction.

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You are reading this ad. So are others. That is why it will pay you to advertise in these columns.

Machinery For Sale

DRYERS—Direct-heat rotary dryers, 3x25 ft., 3½x25 ft., 4x30 ft., 5x35 ft., 5½x50 ft., 6x50 ft. and 7½x60 ft.; double shell dryers, 4x20 ft., 5x30 ft. and 6x35 ft.; steam-heated air rotary dryers, 4x30 ft. and 6x30 ft.

KILNS—Rotary kilns, 8x60 ft., 6x60 ft., 3½x25 ft. and 3x25 ft.

MILLS—24-in., 22-in. and 16-in. Schutz-O'Neill mills; 6x5-ft., 2½x3-ft., 3x3½-ft. pebble mills; 5x3½-ft., 6x6-ft., 6x4-ft., 4½x3½ and 2½x2½-ft. ball mills; 3-ft. Marcy mill; 33-in. and 24-in. Fuller-Lehigh mills; 4½x20-ft., 5x11-ft., 5x22-ft. and 6x20-ft. tube mills; 20x13-in., 9x12-in., 7½x13-in., and 7x10-in. jaw crushers; one type "A" and one No. 3 Williams' swing hammer mills; one Kent type "G" mill; one Aero pulverizer, type "D"; two 36-in. and one 42-in. cage mills; one 8-ft., two 4½-ft. and two 3-ft. Hardinge conical mills; 18x12-in., 20x12-in. and 30x10-in. roll crushers; No. 0, No. 1 and No. 3 Sturtevant rotary crushers; one No. 2 Sturtevant ring roll crusher; one 4-roll Raymond mill; one No. 5 Telsmith breaker; one 36-in. Sturtevant emery mill; four Giant Griffin mills; one Junior Griffin mill; one 51x14-in. chaser mill.

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All this equipment is complete and in good condition.

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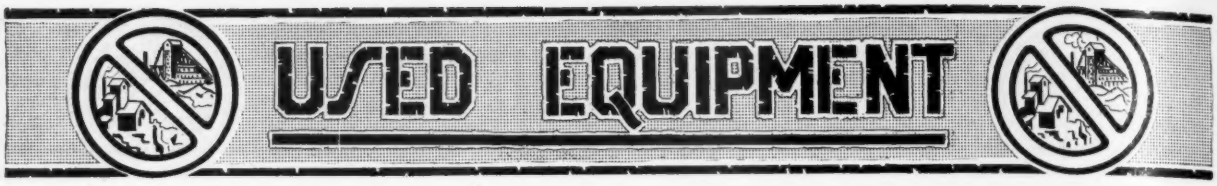

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1—No. 8 Gates reg. drive, Ohio ship.
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1—2400 ft. Sullivan two stage, and 3000 ft.
1—95 H. P. Loco. type boiler, Illinois ship.
75—Steam and centrifugal pumps.
1—30-60 H.P. Emerson-Brantingham tractor.
1—No. 4 CRUSHING PLANT (A.C. motor drive). Concrete mixers—contractors' equipment.

Send us your inquiries for electrical equipment, engines, hoists, etc.

Ross Power Equipment Co., Indianapolis Indiana

For Sale

1—35 H.P. 230 Volt D.C. General Electric Motor. Speed 600 R.P.M., equipped with pulley 9" dia., 12" face.

1—No. 6-D Gates gyratory crusher, Shop No. 4502, in good operating condition. Regular drive.

1—Open end rotary screen, 72" diameter by 16' long. Complete with perforated plate screen sections and jacket. Steel frame. Extra well built.

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269 ft. 12" 8-ply	$1.66 per ft.
150 ft. 14" 8-ply	1.94 per ft.
978 ft. 16" 8-ply	2.22 per ft.
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Offered at an unusually low price.

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Write for our Latest Big Bulletin.

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Standard Gauge Locomotives

1—15-ton four-driver saddle-tank Vulcan.
1—43-ton four-driver saddle-tank Vulcan.
1—40-ton 17x24" four-wheel switcher.
2—50-ton 18x24" six-wheel switchers.
2—14-ton 9x14"—36" gauge Vulcans.

Miscellaneous

1 Model 28 Marion traction shovel.
1—Monighan dragline, 125-ft. boom and 3-yd. bucket.
1—Bucyrus dragline, 60' 0" boom and 2-yd. bucket.
13—16-yd. dump cars.
40—60,000-lb. capacity flat cars.
1—Western standard gauge spreader.
2—1-yd. Foote side-discharge concrete mixers. 50-lb. and 56-lb. rail, ties, 1¼-yd. clamshell bucket, 10-H.P. and 45-H.P. upright boilers, railway equipment, etc.

Industrial Equipment Co., McCormick Bldg., Chicago, Ill.

FOR SALE

1—Gates No. 5 type "K" Gyratory Crusher, standard back drive, extra new pinion, chilled iron fitted, excellent condition. Also all sizes Jaw and Gyratory Crushers, all types, capacities Pulverizers.

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FOR SALE

Slack-dragline outfit complete. 1½-yd. Dull bucket, steel mast, 650 ft. track cable, haulage cables, all anchor bolts, take-up rods, clamps and fastenings in first-class shape. Like new, only used a short time.

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Help Wanted

WANTED

Experienced trap rock crushing plant operator. Plant consisting of 60" x 84" jaw crusher, nine gyratory crushers, electrically driven. Must have thorough knowledge of economical production for continuous operation. State age, experience, reference and salary wanted.

Box 1399 Care of Rock Products

WANTED

Mechanic to keep up crushing machinery at trap rock quarry. Must be thoroughly familiar with Gates crushers and not afraid of hard work. Permanent position for good man. Advise age, experience and salary expected. Address

Big Rock Stone & Construction Co.

111 Center Street, Little Rock, Arkansas

WANTED

Superintendent capable of taking complete charge of large stone crushing plant equipped with modern machinery throughout. Necessary that applicant be good organizer and be fully experienced. Address

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Young man for quarry foreman 30 miles south of Macon, Ga. To handle small gang in soft rock quarry. A permanent position for right man. State age, married or single, experience and salary expected. Address

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Help Wanted

Wanted

Young Superintendent for Lime Burning and Grinding Plant. Must understand machinery. Plant located in Massachusetts. Write giving full particulars, including salary. Address

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SITUATION WANTED

Superintendent desires engagement where thorough knowledge of operation is essential for economical production; thorough knowledge of heavy blasting and efficient upkeep of machinery. References. Address

Box 1351 Care of Rock Products

SITUATION WANTED

A man 35 years of age desires engagement as superintendent where familiarity with, and thorough knowledge of, the handling of steam shovels, locomotives, and the general repair of machinery is involved. 15 years' experience. A1 reference. Address

C. S., 110 Fourth St., Northumberland, Pa.

High grade quarry executive open for position. Thoroughly experienced in every department of quarry and plant operation and management. Accustomed to handling large production of commercial crushed stone. Energetic and dependable. Connection desired with reliable, progressive company. Address

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Plants For Sale

FOR SALE LIMESTONE QUARRY

No. 7½ and No. 5 Gyratory Crushers and complete equipment. High calcium stone. Plant located in central Ohio on N. Y. C. R. R.

F. J. Colgan, Columbus, Ohio

Plants For Sale

Live Material Business For Sale

We offer for sale our building material business, including stock in trade, accounts, equipment, good-will, etc., situated in an Illinois town of about 30,000 population and having an industrial payroll of about $30,000,000 a year. Our sales run a quarter of a million a year. Get in touch with us at once. Address

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You can produce sales or inquiries with personal letters. Many concerns all over U. S. are profitably using Sales Letters we write. Send for *free* instructive booklet, "*Value of Sales Letters.*"

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Sand and Gravel Plants
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Hydraulic dredging equipment of my design now operating has annual capacity of over 25,000,000 cu. yds. Make use of the experience gained by 15 years' intensive study of problems of pumping solids before deciding upon the equipment for your new plant or the rehabilitation of your present plant.

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LOCOMOTIVES
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for the manufacture of gypsum products, such as wall plaster, moulding plaster, wall board products, gypsum block products, also mixing plants.

We are prepared to furnish complete machinery-equipment and design and furnish plans for the installation. Consult our Engineering Department. Forty years' experience in designing of wall plaster machinery and plants.

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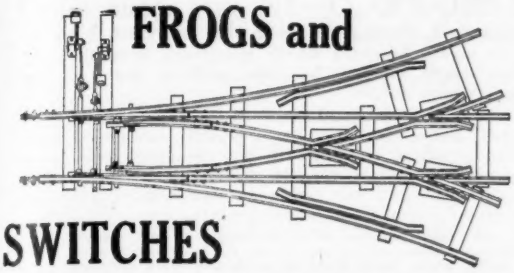

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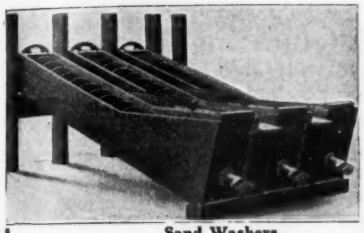

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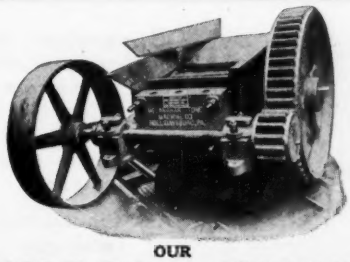

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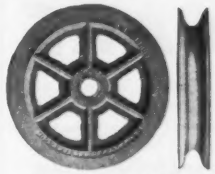

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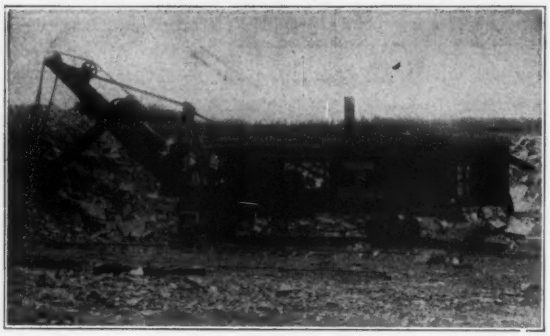

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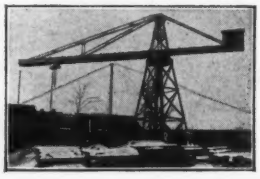

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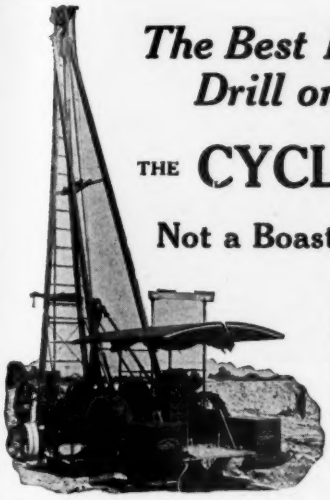

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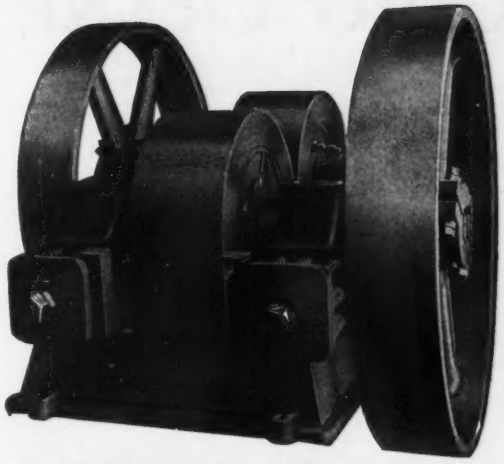

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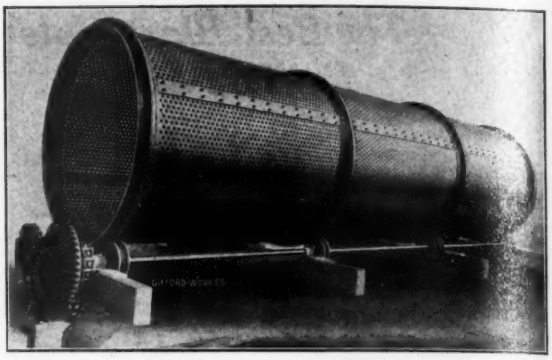

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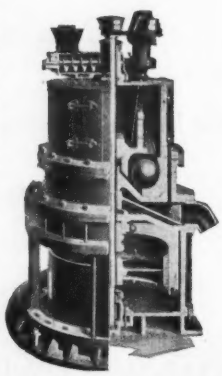

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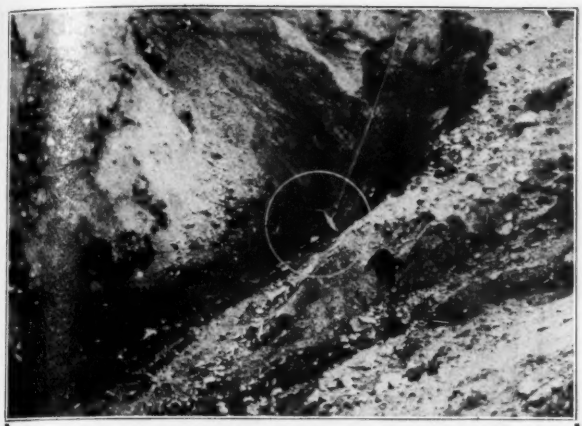

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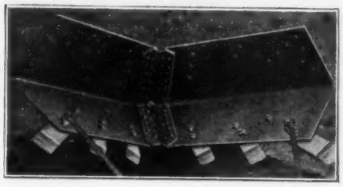

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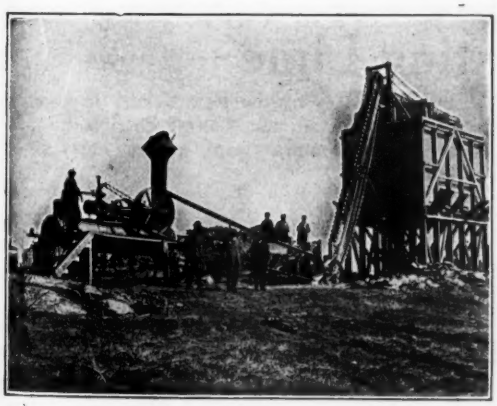

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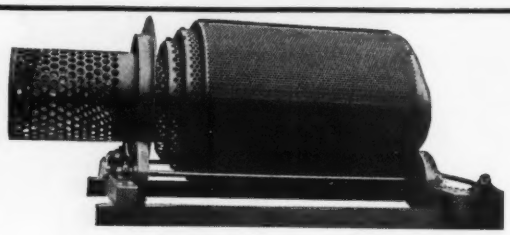

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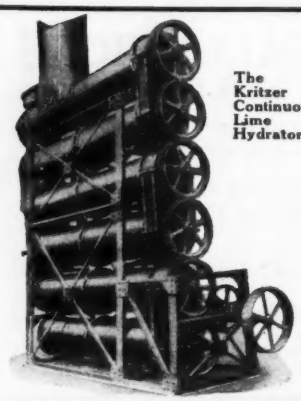

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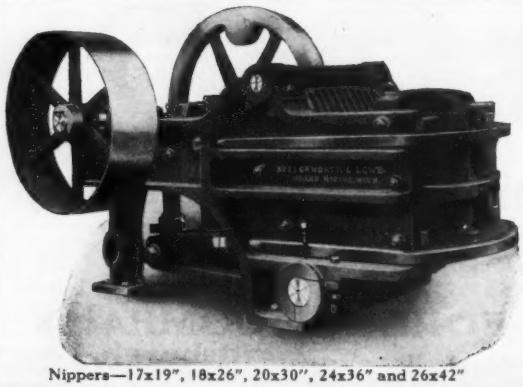

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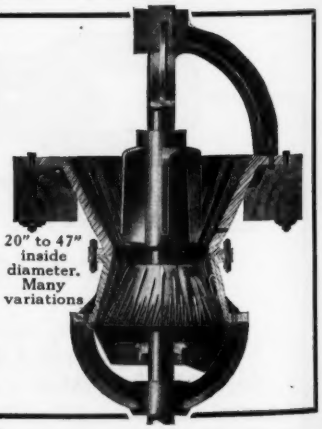

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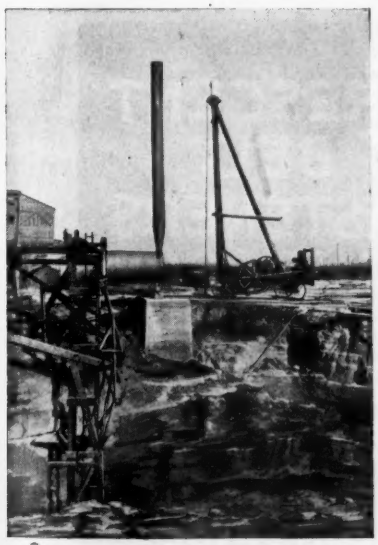

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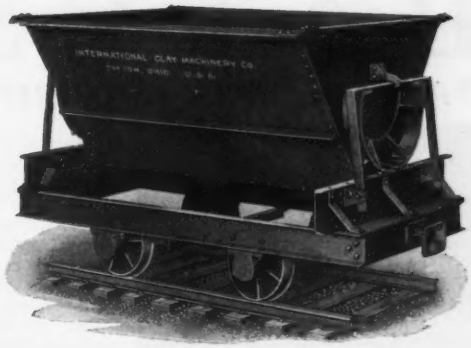

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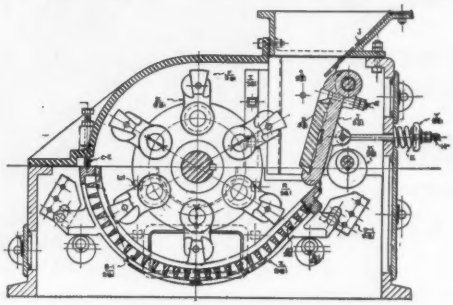

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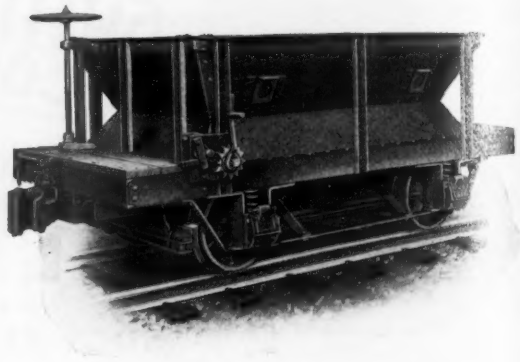

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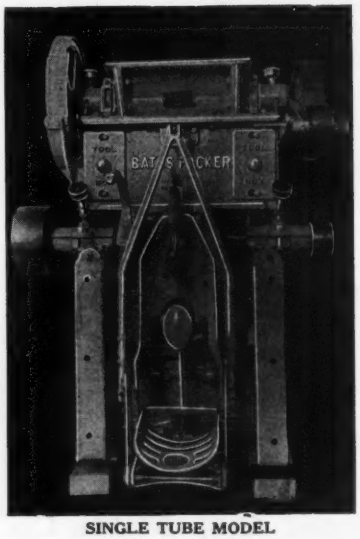

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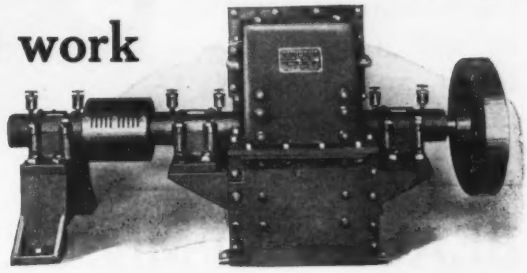

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K-B PULVERIZER COMPANY, Inc., 92 Lafayette St. NEW YORK

K-B PULVERIZER

THE WILLIAMS
2-in-1
CRUSHER

will take Limestone, Lime, Gypsum or Gravel in cubes 14"x16" and under, depending on size of crusher, and in one operation reduce same to 2", 1", 3/4", 1/2", 1/4" or finer. Capacities range from 1 1/2 to 40 tons per hour. Noteworthy features are: Low Horse Power, Slow Speed, High Capacities, Small Floor Space and Instantaneous Adjustment for Different Sized Products. Complete information in Bulletin 4-213.

The Williams Pat. Crusher & Pulverizer Co.
General Sales Dept., 37 W. Van Buren St.

Plant ST. LOUIS — CHICAGO — 67 Second St. SAN FRANCISCO

LOCOMOTIVE CRANES
CLAM SHELL BUCKETS - SHIPBUILDING CRANES
CAR DUMPERS PILE DRIVERS
THE McMYLER INTERSTATE CO.
CLEVELAND OHIO

A CRANE WITH A RECORD FOR SPEED

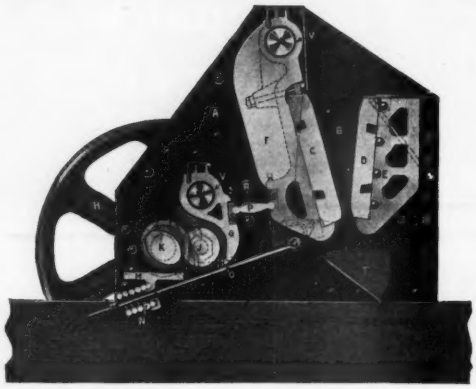
A McMyler Interstate Type "B" Crane, equipped with a McMyler Interstate Clam-Shell Bucket, made a record of 13 trips in 8 minutes, swinging at 90° each trip. The speed is important, but the fact that the crane will stand up under continuous service such as this is more important. The first cost of a crane is of little importance if a large percentage of return is insured. Greater speed, consequent greater capacity, together with low maintenance cost, make the Type "B" one of the best "buys" on the market.

The McMyler Interstate Co., Cleveland, O.

BRANCH OFFICES:
New York—1758 Hudson Terminal Bldg. Seattle ——— Hoge Bldg.
San Francisco—Merchants Exchange Bldg. Denver ——— 18th and Wazee Streets
Chicago ——— 812 Edison Bldg.

Beaumont Rock Crushers

Every purchaser of a crusher is interested in the amount of stone that can be produced by the machine. Size for size, the Beaumont crusher will produce as much, and probably more, stone than any other crusher made, because it is constructed to withstand continuous use.



In our Catalog 42, the construction, operation and efficiency of the Beaumont Rock Crusher is very clearly described.

Write for the Catalog Today

BEAUMONT Mfg. Co., 326 Arch St., Philadelphia

Manufacturers of Road Building Machinery—Crushers, Graders, Elevators and Screens

New York, 50 Church St. Pittsburgh, Bessemer Bldg. San Francisco, 461 Market St. Middle Western Agents, Machinery Sales Co., Old Colony Bldg., Chicago. Southern Representative, B. C. Scott, Charlotte, N. C.

The Bradley Hercules Mill

Built for the Preliminary Pulverizing of Cement Materials

In Operation at the Largest and Most Successful Cement Plants Since 1913—More Popular Than Ever and More Successful

13 Mills Sold to Pennsylvania Manufacturers
Other Installations in Tennessee—New York—North Carolina—Illinois—Oklahoma—California—Washington—Cuba—Argentine

It's the largest preliminary machine manufactured adapted for pulverizing Cement Rock, Limestone or Clinker.

One manufacturer with two mills ground 170,000 barrels Clinker in one month—another manufacturer has averaged 40 tons per hour, when grinding Limestone over a period of several years of operation.

It's a Wonderful Labor and Power Saver

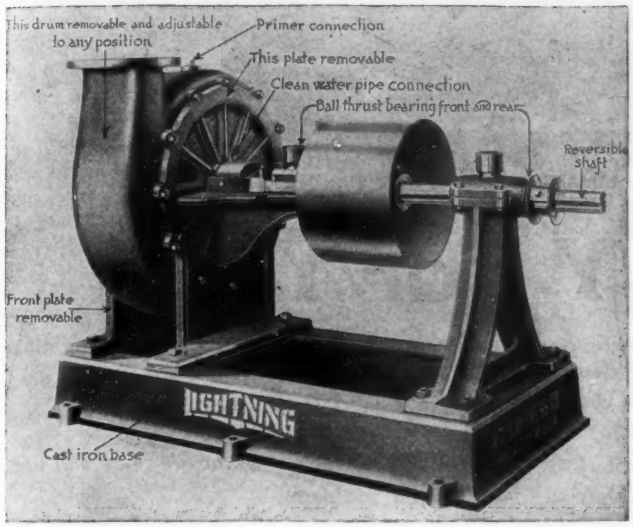
Our Engineers will gladly show you how this mill will reduce your present operating costs, using your present tube mill equipment, and increase your output.

BRADLEY PULVERIZER COMPANY

Works: Allentown, Pa. **BOSTON, MASS.**

Manufacturers of Pulverizing Machinery for 30 Years

The Lightning Sand Pump

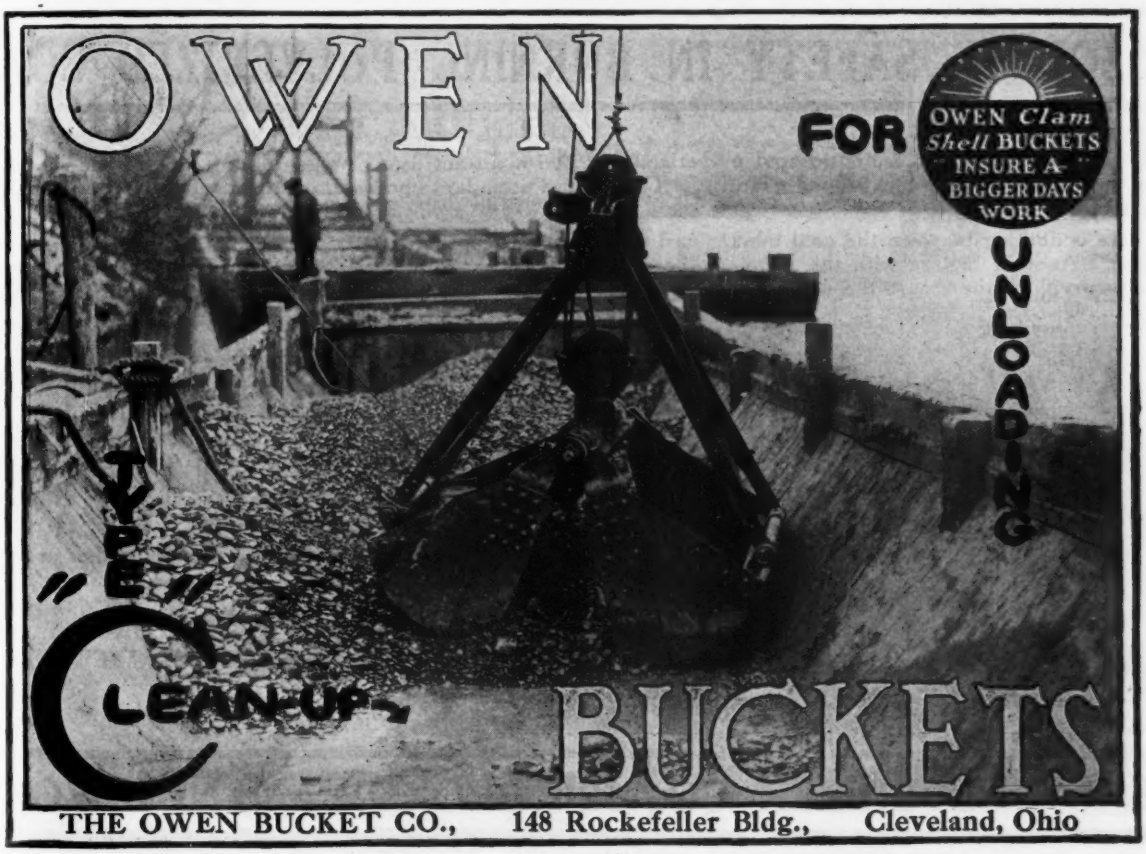


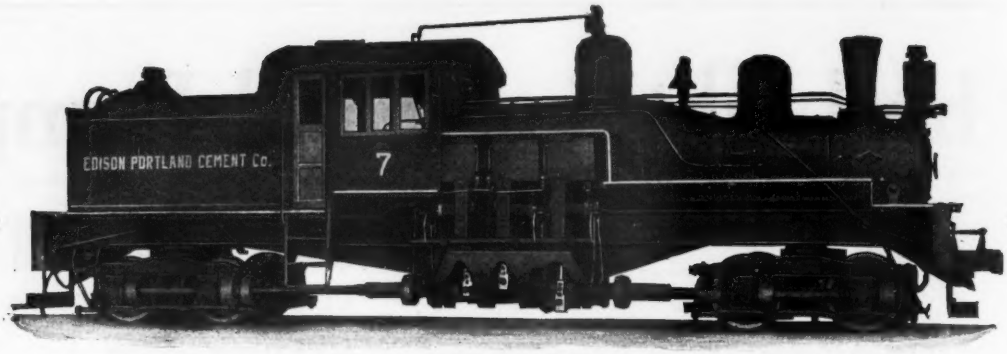
The ideal pump for sand companies and contractors—easy to operate, easy to adjust, easy to replace parts.

Write for Prices and Full Information

Address Pump Dept.

Kansas City Hay Press & Tractor Co., Kansas City, Mo.





60-TON SHAY ENGINE BUILT BY LIMA FOR EDISON PORTLAND CEMENT CO.

A SHAY For You

Close building clearances, lack of repair facilities for an ordinary steam locomotive or high first cost of electrical hauling units may have kept you from installing an industrial railroad.

Let us tell you how our flexible gear-driven Shay locomotive overcomes these difficulties. A Shay requires no special facilities or labor for maintenance. It is built especially for industrial work where large output is an economic necessity.

We will be glad to tell you how a Shay will meet your specific problem.

LIMA LOCOMOTIVE WORKS, Inc.

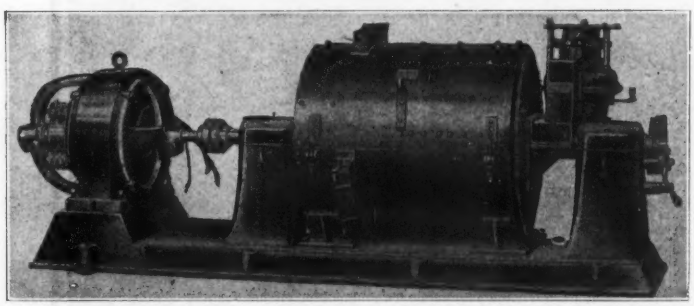
LIMA, OHIO **30 Church St., New York**

ABSOLUTE SAFETY IN BURNING PULVERIZED COAL

By the Aero System there is no coal pulverized except for instant use. As conditions call for the supply so does the Aero produce the proper quantity. The hazard attendant upon storage of the coal powder is entirely eliminated.

There is nothing between the coal bunker and the furnace except the Aero, its motor and a plain pipe connection. Another feature with the Aero—if the coal supply is sheltered from rain and snow no artificial drying is necessary. Neither must the coal be of a very high grade—low cost slack coal can be made to yield its last B. T. U.

The AERO PULVERIZER



is designed as a complete unit for one furnace. They are built in five standard sizes ranging in capacity from 600 lbs. to 5,000 lbs. of coal per hour. Dust-proof and strongly built. All parts susceptible to wear are easy of access.

BACKED BY THE LONGEST SUCCESSFUL SERVICE

Write for Bulletin

AERO PULVERIZER CO., 120 BROADWAY, NEW YORK

When You Think of Buchanan–Think of Crushers

BUCHANAN CRUSHERS

The Guide for Crusher Buyers

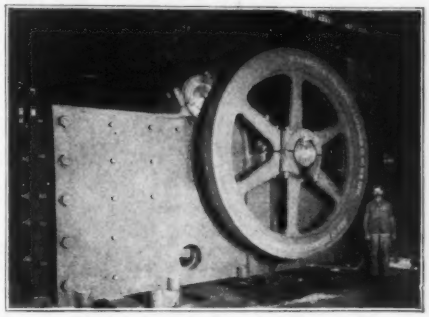
BUCHANAN JAW CRUSHERS
ALL STEEL PATENTED

Where hard crushing work is to be done the milling and crushing plant operators throughout the United States and foreign countries have shown a marked preference for BUCHANAN CRUSHERS.

Their all steel construction enables them to stand the severest strains. They stand up to the service and deliver the output expected of them.

Side Frames, Front and Rear Head, Pitman, Swing Jaw, and Toggles of the very best quality of Open-Hearth Steel, thoroughly annealed.

All joints under strain carefully machined, Water Jacketed Bearings, Spring Balanced Parting Pitman and adjustable jaw stroke.



Shall we send you Bulletin No. 10?

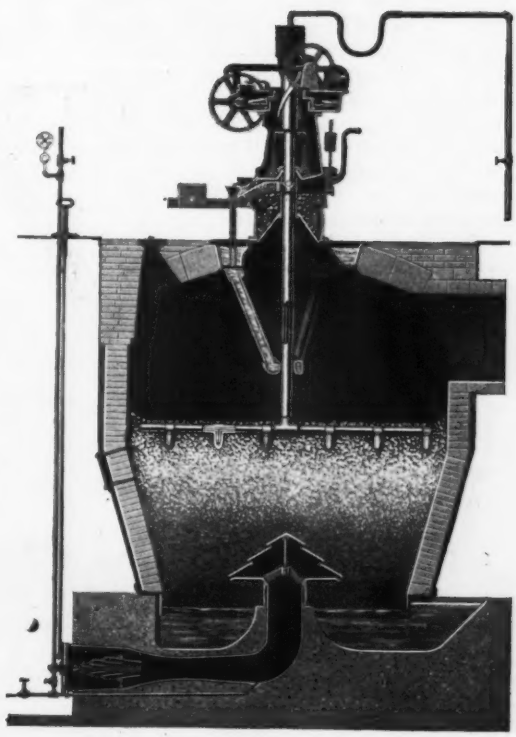
C. G. BUCHANAN CO., Inc.
90 West Street New York
Southwestern Office: Mills Building, El Paso, Texas

When You Think of Crushers–Think of Buchanan

Increase Your Production

of high grade lime by heating your kilns with producer gas generated in

CHAPMAN Agitator Producers



They deliver a constant supply of high quality gas, thus insuring a uniform temperature in the kiln. This uniform supply of high quality gas burns with a long, clear flame which resembles the flame from a wood fire. The result is a greater production of first grade lime.

The Chapman Floating Agitator will increase the capacity and the efficiency of hand-poked producers already in operation.

Write us for special information

The Chapman Engineering Company
Oliver Bldg. Pittsburgh **MT. VERNON, OHIO** 11 Broadway New York

"Arno" Conveyor Belts

Withstand the terrific wear of carrying stone, sand, gravel, grain, coal products, wood, pulp, etc. Made with or without reinforced covers. The ideal belt for conveying purposes.

"Sandow" Sand Suction Hose

Especially built for sand and gravel suction. Cylinder bore throughout with internal diameter to fit snugly over standard iron pipe of corresponding size. Built oversize.

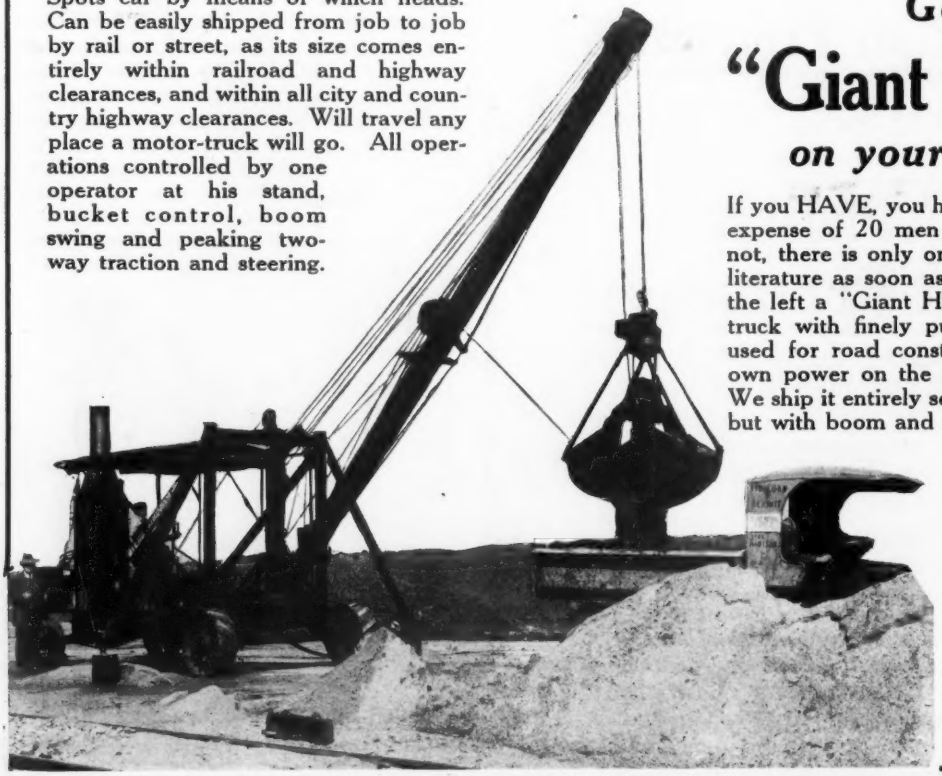
"Norka" Red Sheet Packing

None better made. Will not crack or harden; impervious to action of steam, acid, oil, ammonia, etc. Standard 200-pound rolls. Stocked in all sizes.

"Our Goods will wear out but they take their time about it."
Write for information and catalag

The CINCINNATI RUBBER MANUFACTURING CO.
MAKERS OF HOSE, BELTING, PACKINGS AND OTHER MOLDED RUBBER SPECIALTIES
CINCINNATI, OHIO, U. S. A.

Spots car by means of winch heads. Can be easily shipped from job to job by rail or street, as its size comes entirely within railroad and highway clearances, and within all city and country highway clearances. Will travel any place a motor-truck will go. All operations controlled by one operator at his stand, bucket control, boom swing and peaking two-way traction and steering.



Got a

"Giant Hunky"

on your payroll?

If you HAVE, you have been able to cut the expense of 20 men or more. If you have not, there is only one remedy—write us for literature as soon as you can. We show at the left a "Giant Hunky" loading a motor-truck with finely pulverized shale dressing used for road constructing. It runs by its own power on the ground—needs no rails. We ship it entirely set up and ready to work, but with boom and wheels removed.

Write for further information

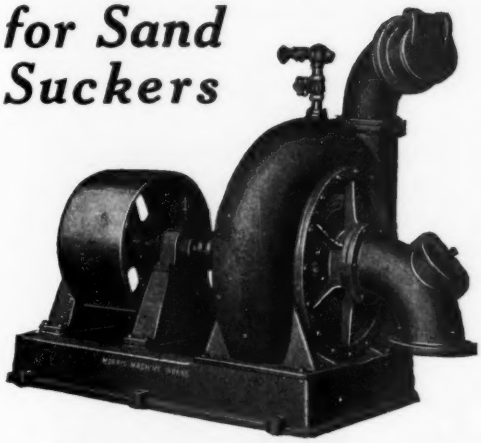
John F. Byers Machine Co.

Steam, Gasoline or Electric Power-Roadwheels or Caterpillars

310 Sycamore St.
RAVENNA, OHIO

A MORRIS PUMP

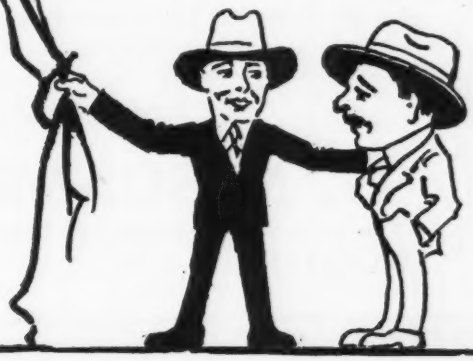
for Sand Suckers

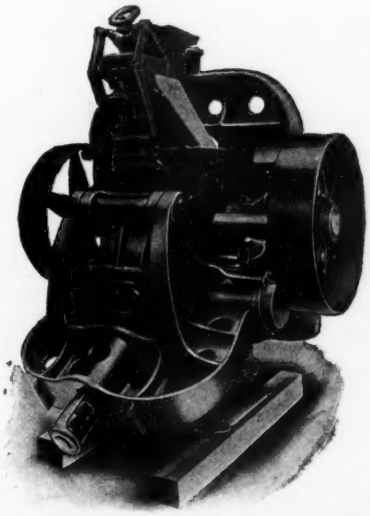


Since 1864 Builders of Dredges, Centrifugal Pumps, Steam Engines

MORRIS MACHINE WORKS
BALDWINSVILLE, NEW YORK

"Yes, the 14-in. MORRIS on the good sand-sucker "PENNSYLVANIA" handled some 200,000 yards in the season, with an average pumping time per day of only about 3 hours. The rest of the day was spent in going to and from the pumping ground and unloading. Yes, the Niagara Sand Corporation of Buffalo were **satisfied** with their MORRIS investment. The Chief Engineer on the "Pennsylvania" wrote us: "I was not delayed a single moment this last season or had to lay out one cent for repairs other than a small change I made." Performance again proves MORRIS Reputation.





MAXECON MILL

Preliminary Grinder for Tube Mills

LIMESTONE .....20 to 40 Mesh
CEMENT CLINKER .....20 to 60 Mesh

MAXECON MILL
PERFECTION SEPARATOR

The UNIT that has LARGER OUTPUT with LESS POWER WEAR and ATTENTION than any other.

It will be to the interest of those who operate CEMENT PLANTS to know what the Maxecon Unit will do.

Drop us a line **We will be glad to tell you about it**

Kent Mill Company

10 Rapelyea Street **BROOKLYN, N. Y.**

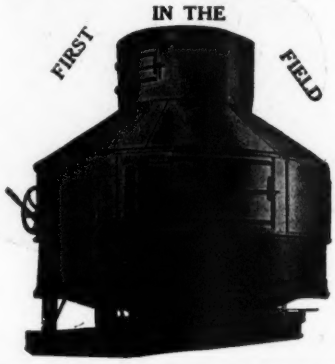
The Clyde Lime Hydrator Performance Counts

The Clyde was first in the field, and through dependable and economical performance is still first choice of lime operators.

The Clyde Hydrator produces big capacities of lime at only three-fifths the cost of any other hydrator on the market.

The Clyde not only produces over 90% of the hydrate of America, but makes the best quality of finishing lime from either high calcium or magnesium.

Simple, easiest to operate, and most economical in cost of installing, maintaining and operating.



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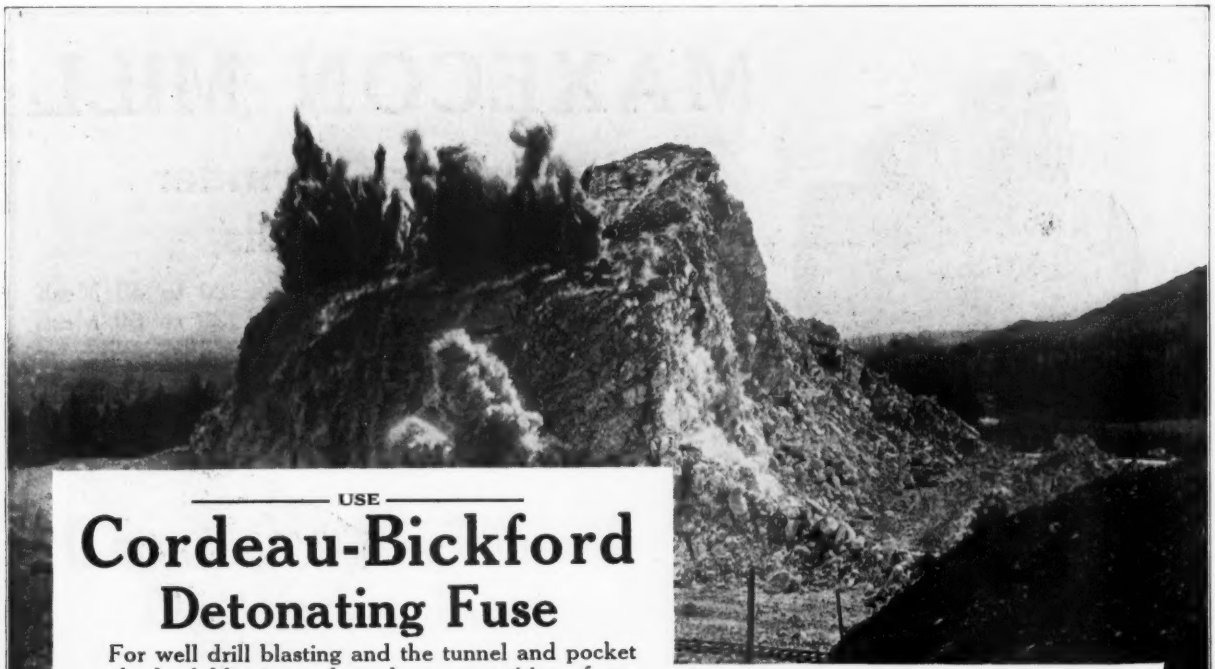
H. MISCAMPBELL

Patentee and Sole Manufacturer

DULUTH - - MINNESOTA



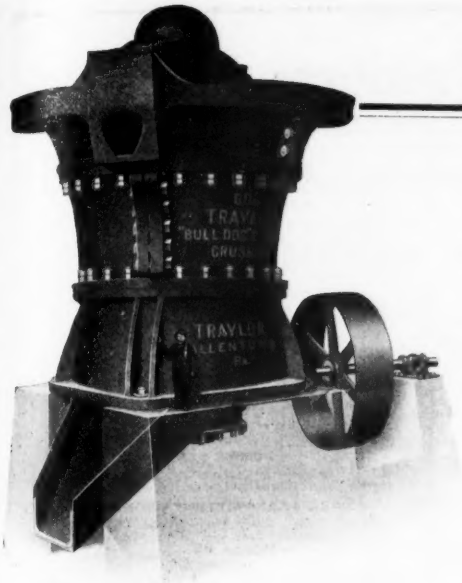
USE

Cordeau-Bickford Detonating Fuse

For well drill blasting and the tunnel and pocket method of blasting, where large quantities of explosive are to be detonated, use safe, efficient Cordeau-Bickford and get lower blasting costs.

The Ensign-Bickford Co., Simsbury, Conn.

Established 1836 **Original Makers of Safety Fuse**



Tremendously Strong Where Other Gyratories Are Weak

The Bend-Proof Shaft—the Hewes Spider—the larger eccentric—the cut steel gears—every feature contributes its quota to the exceptional performance and dependability of

Traylor "Bulldog" Gyratory Crushers

Bulletin GX-1
fully describes the "Bulldog" features.
Write for your copy.

Traylor Engineering & Manufacturing Co.
Allentown, Pennsylvania

New York 30 Church St. | Pittsburgh 211 Fulton Bldg. | Chicago 1414 Fisher Bldg. | Los Angeles Citizens Bank Bldg. | Spokane Mohawk Block

SCHAFFER
Continuous Lime Hydrators

AUTOMATIC operation delivers lime by **weight,** not volume, to the Schaffer Hydrator. Automatically, water, too, is added in correct proportion—insuring a continuous flow of a superior product.

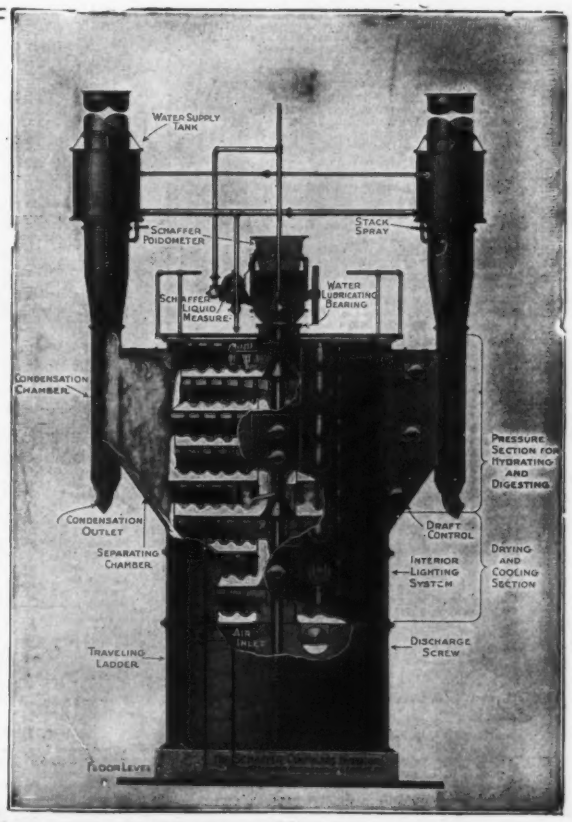
The flexibility of control enables the use of either high calcium or dolomite lime, while at the same time the automatic operation of Schaffer Hydrators solves the labor problem, as they require but little attention.

Our literature on the Schaffer Hydrator covers all the questions you now have in mind. Write for it at once!

Schaffer Engineering & Equipment Co.

James Bldg., Chattanooga, Tenn.

Peoples Bank Bldg., PITTSBURGH, PA.



Buyers' Guide of the Rock Products Industry

Classified Directory of Advertisers in Rock Products

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Worthington Pump & Mach. Co., New York City.

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Jaite Company, The, Jaite, Ohio.
Valve Bag Co. of America, Toledo, Ohio.

BELTING
Cincinnati Rubber Mfg. Co., Cincinnati, Ohio.
Hettrick Mfg. Co., Toledo, Ohio.
Main Belting Co., Philadelphia, Pa.
New York Belting & Packing Co., New York City.
U. S. Rubber Co., New York City.

BELT FASTENERS
Crescent Belt Fastener Co., New York City.

BELT LACING
Crescent Belt Fastener Co., New York City.

BELT RIVETS
Crescent Belt Fastener Co., New York City.

BIN GATES
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Weller Mfg. Co., Chicago, Ill.

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Atlas Powder Co., Philadelphia, Pa.
Du Pont de Nemours & Co., E. I., Wilmington Del.
Grasselli Chemical Co., Cleveland, Ohio.

BUCKETS, ELEVATOR
Hendrick Mfg. Co., Carbondale, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.

BUCKETS
Advance Eng. Co., Cleveland, O.
Browning Co., Cleveland, Ohio.
Marion Steam Shovel Co., Marion, Ohio.
McMyler Interstate Co., Cleveland, Ohio.
Owen Bucket Co., Cleveland, Ohio.

CALCINING MACHINERY
Atlas Car & Mfg. Co., Cleveland, Ohio.
Butterworth & Lowe, Grand Rapids, Mich.

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Track Equipment Co., Huntington, W. Va.

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U. S. Chain & Forging Co., Pittsburgh, Pa.

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U. S. Chain & Forging Co., Pittsburgh, Pa.

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American Hoist & Derrick Co., St. Paul, Minn.

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Sturtevant Mill Co., Boston, Mass.
Universal Road Mach. Co., Kingston, N. Y.
Webster Mfg. Co., Tiffin, Ohio.
Weller Mfg. Co., Chicago, Ill.

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Locomotive Gantry
American Crane & Eng. Co., Toledo, Ohio.
American Hoist & Derrick Co., St. Paul, Minn.
Advance Eng. Co., Cleveland, O.
Ball Engine Co., Erie, Pa.
Browning Co., Cleveland, Ohio.
Byers Mach. Co., John F., Ravenna, Ohio
Chisholm-Moore Mfg. Co., Cleveland, Ohio.
McMyler-Interstate Co., Cleveland, Ohio.
Link-Belt Co., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, Ohio.
Osgood Co., The, Marion, Ohio.

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Smidth & Co., F. L., New York City.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.
Yates, Preston K., New York City.

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Green, L. P., Chicago, Ill.
Marion Steam Shovel Co., Marion, Ind.
Owen Bucket Co., Cleveland, Ohio.

EXCAVATORS
Dragline Cableway
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Ensign-Bickford Co., Simsbury, Conn.

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Caldwell, H. W., & Sons Co., Chicago, Ill.
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GLASS SAND EQUIPMENT
Lewistown Fdy. & Mach. Co., Lewistown, Pa.

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American Hoist & Derrick Co., St. Paul, Minn.
Chisholm-Moore Mfg. Co., Cleveland, Ohio.
Vulcan Iron Works, Wilkes-Barre, Pa.

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Water, Steam, Air Drill, Pneumatic Tool
Cincinnati Rubber Mfg. Co., Cincinnati, O.
N. Y. Belting & Packing Co., New York City.

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Atlas Car & Mfg. Co., Cleveland, Ohio.
Kritzer Co., The, Chicago, Ill.
Miscampbell, H., Duluth, Minn.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.

HYDRAULIC DREDGES
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International Clay Machine Co., Dayton, Ohio.
Koppel Indust. Car & Equip. Co., Koppel, Pa.
Watt Mining Car Wheel Co., Barnesville, Ohio.

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Arnold & Weigel, Woodville, Ohio.
Steacy-Schmidt Mfg. Co., York, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

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Ball Engine Co., Erie, Pa.
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Good Roads Mach. Co., Philadelphia, Pa.
Green, L. P., Chicago, Ill.
International Clay Mach. Co., Dayton, O.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Portable Mach. Co., Passaic, N. J.
Stephens-Adamson Mfg. Co., Aurora, Ill.

LOCOMOTIVES
Baldwin Locomotive Works, The, Philadelphia, Pa.
Fate-Root-Heath Co., Plymouth, Ohio.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Lima Locomotive Works, New York City.
Porter Co., H. K., Pittsburgh, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.
Whitcomb Co., Geo. D., Rochelle, Ill.

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Packard Motor Car Co., Detroit, Mich.
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Sheet, Piston, Superheat, Hydraulic
Cincinnati Rubber Mfg. Co., Cincinnati, O.
N. Y. Belting & Packing Co., New York City.

PAINT AND COATINGS
Williams, C. K., & Co., Easton, Pa.

PERFORATED METALS
Chicago Perforating Co., Chicago, Ill.
Cross Eng. Co., Carbondale, Pa.
Hendrick Mfg. Co., Carbondale, Pa.
Johnston & Chapman Co., Chicago, Ill.
Nortmann Duffke Co., Milwaukee, Wis.

PLASTER MACHINERY
Butterworth & Lowe, Grand Rapids, Mich.
Ehrsam & Sons Co., J.B., Enterprise, Kan.

PORTABLE CONVEYORS
Stephens-Adamson Mfg. Co., Aurora, Ill.

PORTABLE STONE BINS
Austin Mfg. Co., Chicago, Ill.

PUMPS
American Well Works, Aurora, Ill.
Worthington Pump & Machine Co., N. Y. City.

PUMPS, SAND
K. C. Hay Press & Tractor Co., Kansas City, Mo.
Morris Mach. Works, Baldwinsville, N. Y.

POWER TRANSMITTING MACHINERY
Caldwell, H. W., & Son. Co., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Weller Mfg. Co., Chicago, Ill.

POWDER
Aetna Explosives Co., New York City.
Atlas Powder Co., Philadelphia, Pa.
Du Pont de Nemours & Co., E. I., Wilmington Del.
Grasselli Chemical Co., Cleveland, Ohio.

PULVERIZED FUEL EQUIPMENT
Aero Pulv. Co., New York City.
Bradley Pulv. Co., Allentown, Pa.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.

PUMP VALVES
N. Y. Belting & Packing Co., New York City.

QUARRY EQUIPMENT
Beaumont Mfg. Co., Philadelphia, Pa.
Marion Steam Shovel Co., Marion, O.
Universal Road Mach. Co., Kingston, N. Y.

SCRAPERS, DRAG
Green, L. P., Chicago, Ill.
Sauerman Bros., Chicago, Ill.

SCREENS
Austin Mfg. Co., Chicago, Ill.
Beaumont Mfg. Co., Philadelphia, Pa.
Cross Eng. Co., Carbondale, Pa.
Gifford-Wood Co., Hudson, N. Y.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Johnston & Chapman Co., Chicago, Ill.
Link Belt Co., Chicago, Ill.
National Engineering Co., Chicago, Ill.
Smith Eng. Works, Milwaukee, Wis.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Stimpson Equip. Co., Salt Lake City, Utah.
Sturtevant Mill Co., Boston, Mass.
Universal Road Mach. Co., Kingston, N. Y.

SCREENING
N. J. Wire Cloth Co., Trenton, N. J.

SEPARATORS
National Engineering Co., Chicago, Ill.
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Sturtevant Mill Co., Boston, Mass.

SEPARATORS, MAGNETIC
Buchanan Co., C. G., Inc., New York City.

SHEAVES
Mayer-Hasseldiek Mfg. Co., St. Louis, Mo.

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Steam and Electric
Ball Engine Co., Erie, Pa.
Bucyrus Company, Milwaukee, Wis.
Marion Steam Shovel Co., Marion, Ohio.
The Osgood Co., Marion, Ohio.
Victor R. Browning & Co., Cleveland, Ohio.

SPEED REDUCING TRANSMISSION
D. O. James Mfg. Co., Chicago, Ill.

STONE ELEVATORS
Austin Mfg. Co., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Weller Mfg. Co., Chicago, Ill.

TANK CRAWLERS
Victor R. Browning & Co., Cleveland, Ohio.

TRACK EQUIPMENT
Central Switch & Frog Co., Cincinnati, Ohio.
Track Equipment Co., Huntington, W. Va.

WASHERS, SAND AND GRAVEL
Good Roads Mach. Co., Philadelphia, Pa.
Smith Eng. Works, Milwaukee, Wis.

WIRE ROPE
American Steel & Wire Co., Chicago, Ill.
Leschen, A., & Sons Co., St. Louis, Mo.
Waterbury Co., New York City.

WIRE CLOTH
Cleveland Wire Cloth Co., Cleveland, Ohio.
New Jersey Wire Cloth Co., Trenton, N. J.

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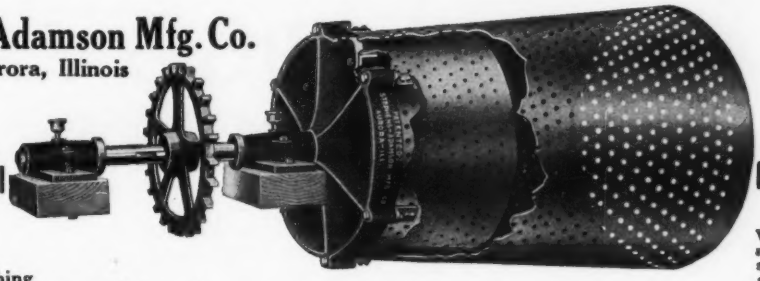
For Washing and Sizing Sand and Gravel

There is a reason for the success of the S-A Gilbert Screen. There is a fundamental principle involved which is responsible for the excellent washing and screening qualities found in this screen.

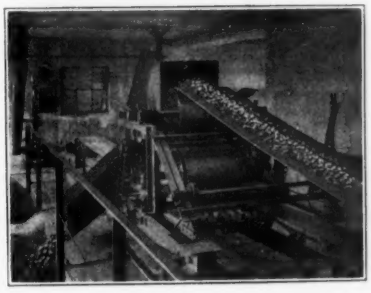
Gravel plants all thru the country are adopting the S-A Gilbert Screen where specification requirements are severe and the product must be carefully sized and thoroly cleaned.

Stephens-Adamson Mfg. Co.
Aurora, Illinois



S-A Gilbert Washing Screen with Inner Wearing Skirt

Write for Section 5 Catalog illustrating and describing S-A sand and gravel washing and screening plants.



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LABOR SAVING MACHINERY

Will help you to operate at full capacity. During the next few years the plant with efficient equipment, doing the work mechanically that has heretofore been done with day labor, will be the one to deliver the goods and make the profit.

We Design and Make

Apron, Belt and Pan Conveyors, Bucket Elevators, Storage Bins, Car Unloaders, Car Loaders, Car Pullers, Traveling Bulk Cement Unloaders, Rotary Screens and Washers, Coal Crushers, Power Transmitting Machinery, etc.

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This Stamp on Steel Chain Insures Service

Weller Made Steel Bushed Conveyor Chain, with case-hardened steel bushings and pins, will give as good service and last as long as any chain made.

We make chain to your specification

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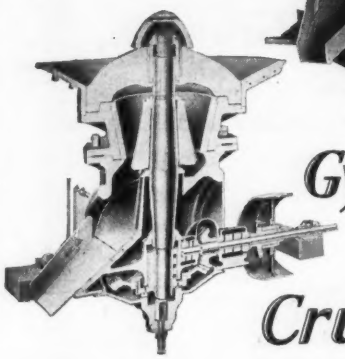


Gyratory Crushers

ON the Austin Gyratory Crusher you will find six points of mechanical superiority — real profit-making features, not merely talking points.

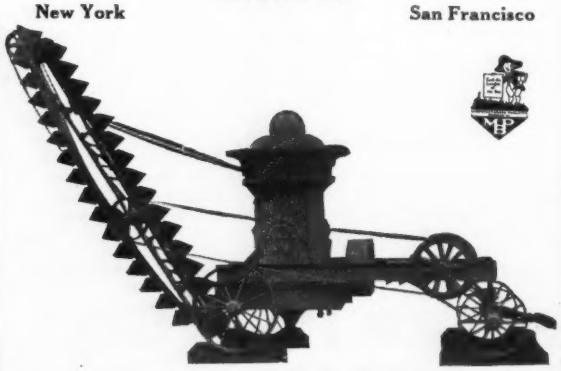
Study the internal construction—the sectional view invites your consideration. Learn about the six Austin Crusher features, and you will standardize on Austin equipment.

Gyratory Crushers are made in eight sizes, capacities 5 to 500 tons per hour —portable and stationary plants.

Write for Catalog 28 describing the complete Austin line of Rock Crushing Equipment.

Austin Manufacturing Co.
CHICAGO

New York San Francisco



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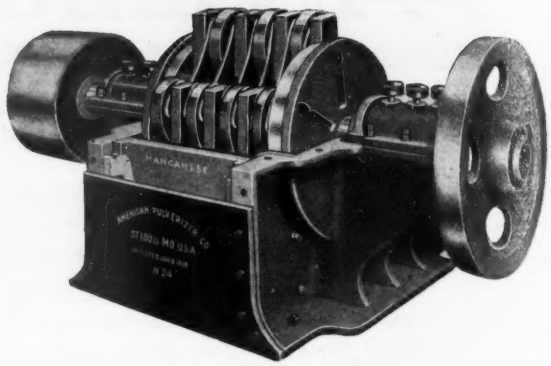

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The Patented AMERICAN RING PULVERIZER

This machine breathes life into sales, makes satisfied come-again customers. The 1920 Limestone demand promises to be far in excess of the supply. Figure out what this means to you, and get lined up to supply your share. The Patented American Ring Pulverizer will unlock new business opportunities. Look over these distinctive features:

1st—There's High Capacity
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4th—Correct Finished Material
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6th—Ease of Operation and Care
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The Columbia Quarry Company, after receiving one, installed three more—results count—now producing 50 tons per hour. You can rely on our crushers for crushing agricultural limestone to 2-inch cubes or under.

Write for Plans and Prices Today

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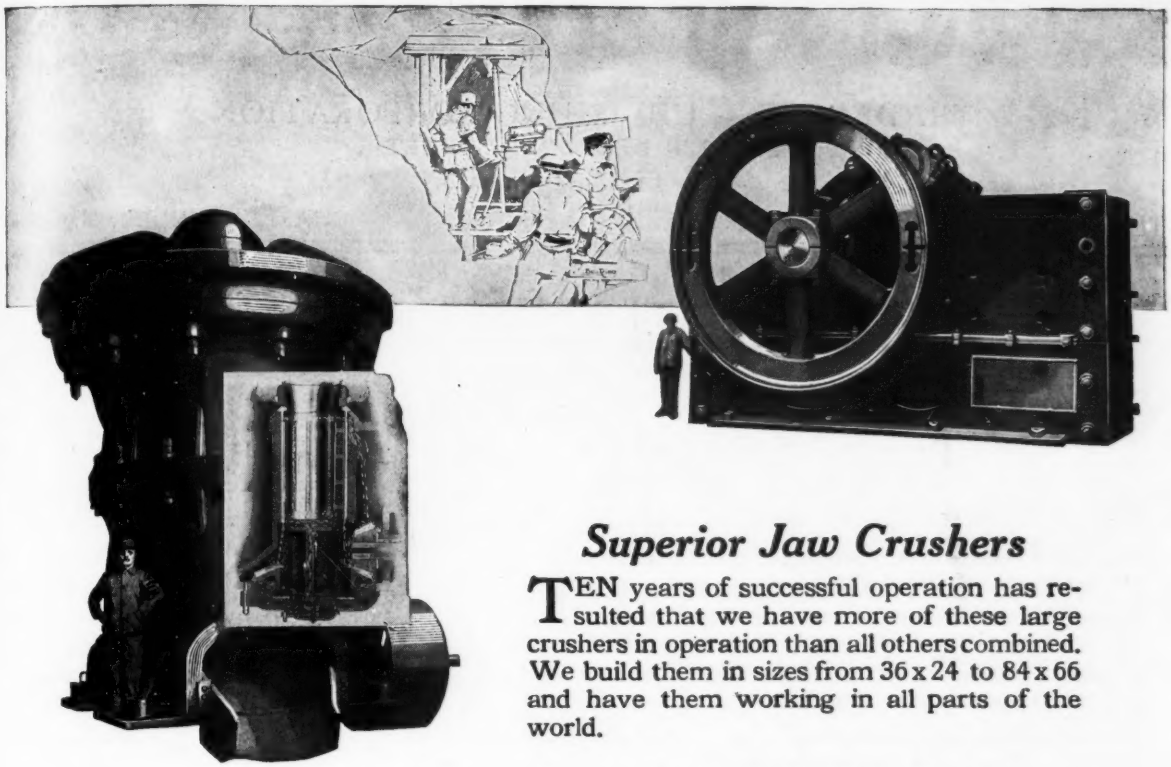

Superior Jaw Crushers

TEN years of successful operation has resulted that we have more of these large crushers in operation than all others combined. We build them in sizes from 36 x 24 to 84 x 66 and have them working in all parts of the world.

Superior McCully Gyratory

SEVEN years of successful operation and over 300 installations in operation on Lime Stone, Trap Rock and hard Iron Ore, prove this machine a good buy. It embodies patented construction features and is built in sizes from 8" to 50" opening.

Both Superior McCully and Superior Jaw Crusher are the original machines of their type and are built at our great Power and Mining works at Cudahy, Wis.

Other Worthington Products

Gyratory Crushers, Jaw Crushers, Air Compressors, Mine Pumps, Revolving Stone Screens, Ball and Tube Mills.

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